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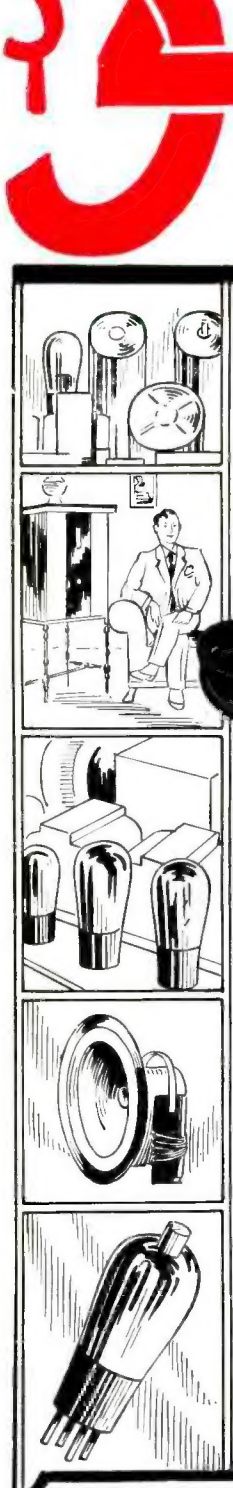

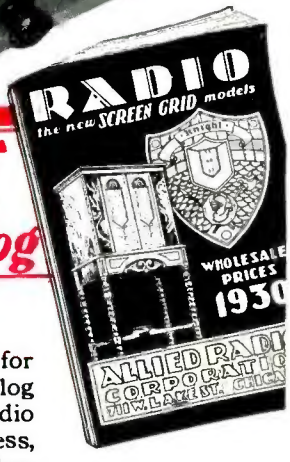

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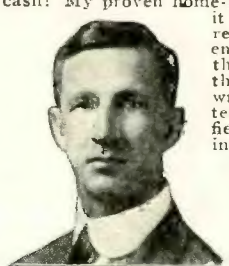

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UP-TO-THE-MINUTE ARTICLES *in this Issue by* WELL-KNOWN AUTHORS

General Science

Have You Musical Fingers?... 676
Editorial... 682
2,500 Feet Under the Sea... 684
By H. E. Serner
Mansions of Mud... 686
By A. Hyatt Verrill, famous Archeologist and Tropical Explorer
Ashes Removed by Vacuum... 687
Newest Aviation Ideas... 688
Gas-Electric Car Has No Gear Shift... 690
This Car Pulls Instead of Pushes... 690
Baird's Newest Televisor... 691
By H. Winfield Secor, E. E.
Measuring Heights and Depths With Sound... 692
By Botho Von Romer, German Correspondent
New York Plans New Tunnel... 693
New Ways to Detect Icebergs... 693
By Dr. Howard T. Barnes, Department of Physics, McGill University
40,000 Horse-power From a Three-Foot Pipe... 694
By Charles W. Geiger
Six Miles a Minute!... 694
Would You Believe It?... 695
New Toys... 696
By Joseph H. Kraus
New York to Manilla by Air... 699
You Can't Fool This Plane!... 699
Some Recent Inventions Based Upon Modern Chemistry... 700
When the Fates Fooled Harry Kellar... 701
By "Dunninger"
In the Scientific Spotlight... 702
Super-Refined Oil... 704
By Alfred M. Caddell
Von Opel Makes First Rocket Plane Flight... 705
Huge Circular Air Station for Kansas City... 705
Amateur Talkie Equipment... 706
What Oil Heat Offers... 707
By Harry F. Tapp
Motor Hints for Owner and Driver... 708
Conducted by George A. Luers
Latest Automobile Devices... 709
Magic—A Monthly Feature... 710
By "Dunninger"
Can You Answer These Scientific Questions?... 711
Cross-Number Puzzle—To Test Your Wits... 715
What Our Readers Think... 722
Scientific Humor... 728
The Oracle... 729
Latest Patents... 730
Financial Article... 764
By Alfred M. Caddell
Patent Advice... 742
By Joseph H. Kraus

Aviation

Newest Aviation Ideas... 688
Latest Aviation Toys for the Kiddies... 696
Six Miles a Minute!... 698
New York to Manilla by Air... 699
You Can't Fool This Plane!... 699
Von Opel Makes First Rocket Plane Flight... 705
Huge Circular Air Station for Kansas City... 705

Chemistry and Electricity

Baird's Newest Televisor... 691
New Ways to Detect Icebergs... 693
Electric Power From Water... 694
Latest Electric Toys... 696
Recent Chemical Discoveries... 700
Super-Refined Oil... 704
How to Make Rayon... 714
Short-Cuts for the Young Chemist... 714

Home Movies

Amateur Talkie Equipment... 706
How to Develop Your Own "Home Movies"... 712
By Don Bennett

Automotive

Gas-Electric Car Has No Gear Shift... 690
This Car Pulls Instead of Pushes... 690
Toy Racing Auto... 696
Making Used Oil Better Than New... 704
Motor Hints... 708
Newest Auto Devices... 709

Radio and Television

Baird's Newest Televisor... 691
Remote Radio Control for the Amateur... 724
Look In! R. C. A. is Televising... 725
New Radio Devices... 726
Radio Oracle... 727

How to Make It

Christmas Gifts From the Home Wood Turner... 713
By H. L. Weatherby
How to Make Rayon... 714
Hints for the Home Workshop... 716
How-To-Make-It Department... 718
Wrinkles and Recipes... 720

NEXT MONTH *and* LATER

The City of Tomorrow Is Space Curved?

A highly interesting article treating in a popular manner the much discussed curved space of Professor Einstein, explained by Dr. Menzel.

How Useless Swamps Are Becoming Airports

Plenty of Construction, How-To-Make-It Articles and Wrinkles

Record-Breaking Model Airplane

Making Silhouettes Without Scissors

Tricks With a Phonograph

WITH OUR AUTHORS

H. E. SERNER, author of "2500 Feet Under the Sea," is a mechanical engineer of many years experience and he has worked out many of the details and the general design of the sub-sea exploring tank used by Dr. Hartman. Dr. Hartman is also an engineer of many years' experience, particularly in the special field of sub-sea photography.

A. HYATT VERRILL, well-known archeologist and tropical explorer, makes annual pilgrimages to his favorite stamping ground—Peru. Mr. Verrill is the author of many extraordinary scientific fiction tales and has written a great deal concerning his interesting discoveries over a period of many years spent in Peru. Mr. Verrill is "full of his subject," and we are sure that our readers will be delighted with his "Mansions of Mud" article in this issue.

DUNNINGER, who writes on "How the Fates Fooled Harry Kellar" in this number, is a famous magician and mentalist of many years experience; he enjoys the unusual distinction of numbering among his personal friends all of the leading magicians. His last story told how fate fooled Houdini.

DR. HOWARD T. BARNES, of McGill University, Montreal, is professor of physics at this famous institution, and he is particularly noted for his work in destroying huge ice jams in rivers by the use of thermit. He is the author of the book "Ice Engineering" and undoubtedly the greatest living authority on the problem of ice elimination.

RICHARD HOADLEY TINGLEY, who prepared the cross-number puzzle on which you will probably expend several hundred foot-pounds of mental energy, is a civil engineer by profession. In his later years he has been writing for a number of leading American magazines and newspapers. Mr. Tingley has prepared a great number of cross-word and cross-number puzzles, which are appearing in newspapers clear across the country. He possesses the happy faculty of not only making a puzzle interesting, but educational as well.

VOL. XVII Whole Number 200 December, 1929, Number 8

SCIENCE AND INVENTION. Published monthly by Experimenter Publications, Inc., at 184-10 Jamaica Ave., Jamaica, N. Y. Entered as second class matter, at the Post Office at Jamaica, N. Y., under the Act of March 3, 1879. Title registered at the U. S. Patent Office.

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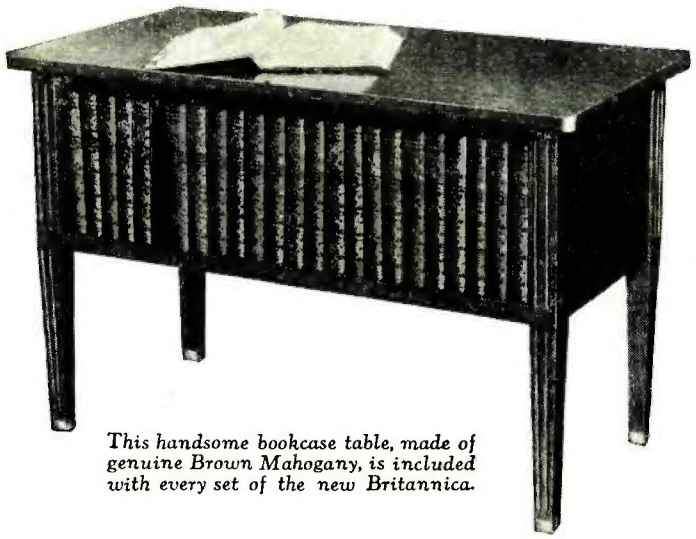

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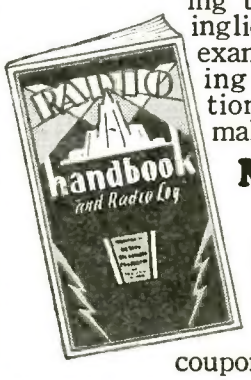

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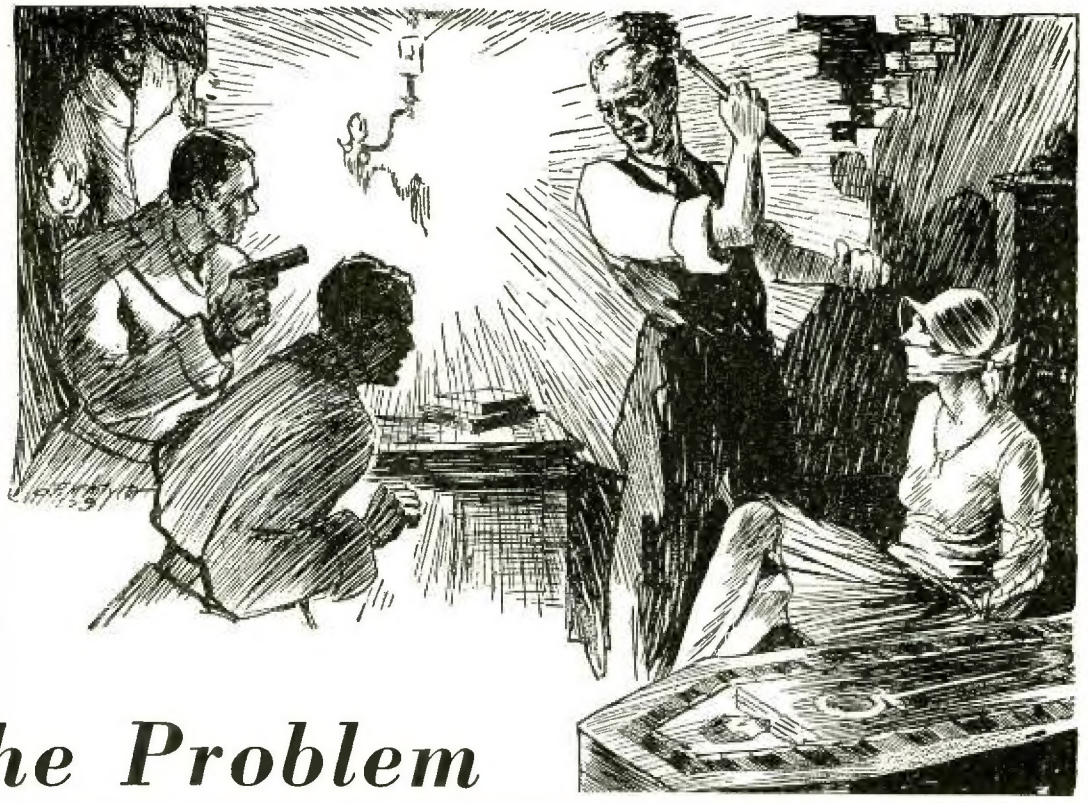

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I like to get hold of the down-hearted—the discouraged—the "has beens" and the "also rans." It gives me a big "kick"—a real thrill—every time I help a man or woman who felt they were failures. It's easy enough to make successful men more successful. But give me the man who is struggling along—trying to make both ends meet—who has never had a real "look-in" on business success. The most fun I get out of life is turning such men into happy, contented, prosperous, independent business men. And I'm doing it right along! There's E. G. Baum, past 50, lost his job as bookkeeper, sick, discouraged, downhearted. I got Baum started and he cleaned up $8,000.00 his first year. And J. M. Patterson. He'd just landed in Texas with a baby, a sick wife and only $10.20 in his pocket. He started to use my Successful Real Estate System, and writes me that he will clean up $20,000.00 in profits this year. Send for my free book. Learn how I am helping others—and how I can help you—win big business success.

New Lives for Old

I teach ambitious men and women my way of making big money in the Real Estate Business, without previous experience. I give them new lives for old. I transform them from low-salaried employees to successful employers—in business for themselves—independent—prosperous—contented—men and women from 21 to 79—from all walks of life—former mill-hands, clerks, railroad men, barbers, hotel employees, grocers, salesmen, bookkeepers, teachers, ministers, printers, musicians, insurance solicitors, etc., etc. Take "Bill" Dakin for example. He worked for fifty years in a New York steel plant. Never had any schooling to speak of. Never had any real-estate experience. Bill jumped at my offer. Writes me that last month he earned $1,125 my way. Write for a free copy of my book today. Learn how wide-awake men and women are changing their jobs—trading old lives for new—with my System for Becoming a Real Estate Specialist. Address President, American Business Builders, Inc., Dept. M-15, 205 East 42 St., New York.

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Eugene Walfrath, formerly in the clothing business. Got my scientific System for making money in real estate. Cleaned up $17,000 in one deal. Free book tells how he did it.

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DECEMBER, 1929
NUMBER 8

Science and Invention

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WHOLE NO. 200

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Editorial

. . . THE TALKIES. One by one, and in large groups, the motion picture houses are going "talky." Within a few months we have witnessed a complete recasting of the motion picture industry. This upheaval has caused many stars to lose their brilliance and has made more lustrous some other lucky individuals who, up to now, never had a chance.

Most of us know little and care less about the mechanics of this change, but it is a most interesting story and is just another indication of the rapidity with which our business methods may be completely upset and rebuilt. New actors, new directors, new continuity writers, new camera men and new technique, are but a few of the changes the talkies have brought us.

From the standpoint of applied science, most of us can learn a great deal from the talkies. When the recording is done by an electrical reproducing method employing wax, great care must be taken in the preparation of the wax to hold what is termed "surplus noise" down to the lowest possible scale. Where the voice and music recording is made a part of the film, there is a great opportunity for chemists to exert their skill in the proper compounding of those chemicals which form the film emulsion, sensitive to the light ray, as well as in the production of the extremely delicate light-sensitive cells which are used in converting the rapidly changing sound frequencies into the light frequencies which are recorded on the film. One of the least understood among the electrical phenomena is high-frequency alternating current. This form of current is, to a large extent, the current used in the talkies. The intricate mechanisms providing synchronism between the electrical and mechanical units, which comprise the recording and reproducing units for the talkies, require an accuracy of manufacture usually confined to such skilled arts as watch manufacture.

The application of a great many of the fundamentals found in the commercial talkies has come directly from the large radio laboratories. This is indeed a fertile field for experimentation, and it is very likely that a great many home talking movie outfits will be used by many experimenters for the development of ideas which will further improve the commercial product.

In spite of the giant strides that have been made in the last year, there is still plenty of room for improvement in color motion picture photography, recording equipment, and the proper application of all of these ideas to fit the particular acoustic properties of the theatres to the talking movie systems.

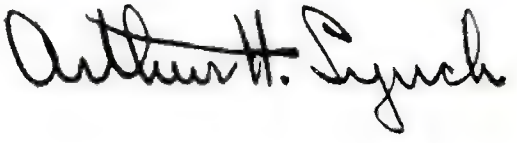
* * *

. . . SANE FLYING. The Department of Commerce insists that pilots engaged in regular passenger transport service shall pass a physical examination every six months. The wisdom of this ruling cannot be questioned. It means better flying by better men, and a very fine protective measure against any irregularities in the actual travel on air routes.

It is very gratifying to know that the Universal Air Lines believes so thoroughly in the fundamental idea, that arrangements are made for examination of every one of its pilots every *two* months. By this method the pilots are known to be in excellent condition, and just as soon as their record indicates a tendency toward staleness, they are given a rest. A few more intelligent steps of this nature will do much to reassure many of those who are still to become air-minded.

* * *

. . . THE ROCKET DRIVE. Fritz von Opel, in Germany, and Prof. Robert H. Goddard, in this country, have been devoting a great deal of time to the study of propelling vehicles by the explosion of rockets. The most recent, and perhaps most spectacular of these tests, was concluded by von Opel a short time ago. He drove a rocket propelled plane a mile and a quarter, at the rate of about 60 miles an hour. The plane he used was to a large extent an adaptation of one of the famous German gliders. This means of providing power for the movement of automobiles and airplanes would, it seems, be extremely expensive and inefficient, but the gentlemen whose energies are being turned in this direction believe that most of the present inefficiency may be eliminated, and that there is a real possibility of applying more highly developed devices of this kind successfully.



"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - HUXLEY

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R. T. I. Home Training Puts You In This Big Money Field

Radio alone, pays over 200 MILLION DOLLARS a year in wages in Broadcasting, Manufacturing, Sales, Service, Commercial Stations and on board the big sea going ships, and many more men are needed. Television and Talking Movies open up other vast fields of money-making opportunities for ambitious men. Get into this great business that is live, new and up-to-date, where thousands of trained men easily earn $60 to $100 a week—where $10,000 a year jobs are plentiful for men with training plus experience.

Easy To Learn At Home—In Spare Time

Learning Radio the R. T. I. way with F. H. Schnell, the "Ace of Radio" behind you is EASY, INTERESTING, really FUN. Only a few spare hours are needed and lack of education or experience won't bother you a bit. We furnish all necessary testing and working apparatus and start you off on practical work you'll enjoy—you learn to do the jobs that pay real money and which are going begging now for want of competent men to fill them.

FRED H. SCHNELL
Chief of R. T. I. Staff

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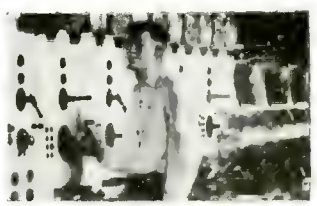

Earned $500 Extra Money in Two Months

Your radio course has enabled me to earn over $500 in two months' spare time work. Understand that this is all spare time work, as I have a permanent position with my father in our store. I give you all the credit for the above and as I said before, I wish to finish the entire course as soon as I can.—Your student, J. NOFFSINGER, Greenville, Ky. R 1, Box 37.

Salary Raised 33 1-3% Since Enrolling

You may be interested to know that I am now Radio Service Manager for the H. N. Knight Supply Co. who are distributors for Eveready Radio Receivers in the State of Oklahoma, and Texas Panhandle, with an increase in salary of about 33 1-3%, since I enrolled with your school.

Thanking you for your interest you have shown in me, and your wonderful course, I am, EARL P. GORDON, 618 East 6th St., Oklahoma City, Okla.

Makes $25 a Day

Haven't forgotten you. How could I when I make as high as $25.00 per day and have made $600.00 in two months from Radio work. That's not so bad when I'm only 19 and in a small town. I just looked over the catalog you sent me before I enrolled, and you did about all you said you would and about as much more.—FLOYD KNISPLY, R. F. D. 2, Box 91, St. Joe, Ind.

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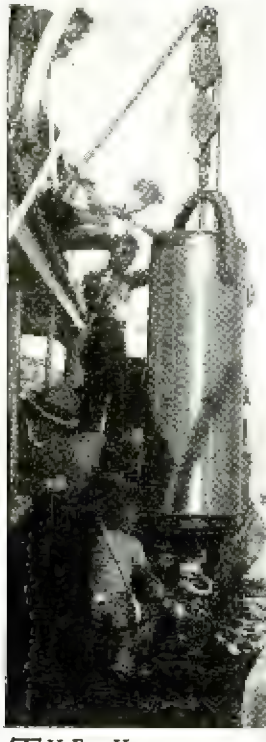


DR. HANS HARTMAN, the hero of our present story and the only man who ever descended to a depth of 2,500 feet beneath the surface of the sea, discovered the ruins of an ancient city at a depth of about 350 feet. Is it the lost Atlantis?

2,500 FEET UNDER *the*

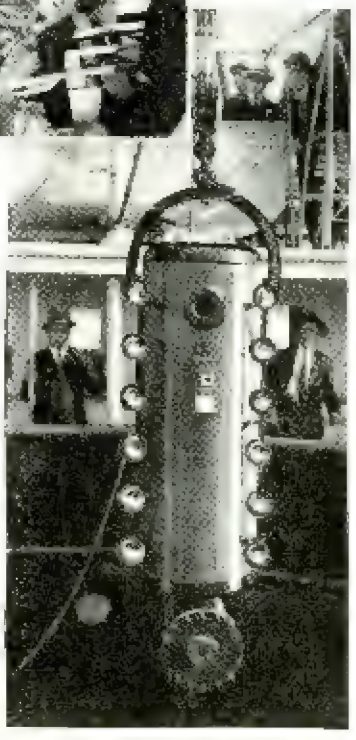
American Scientist Breaks All Depth Sunken City in the Mediterranean.

An Interview with

Dr. Hans Hartman

By H. E. Serner

Consulting Engineer



THE Hartman deep-sea exploring bell, in which he was later submerged to great depths never before reached by man, is shown being hoisted overboard in the Mediterranean in the photo above. In the model of diving bell here shown, the "movie" camera was enclosed in a separate steel bell fitted with a quartz glass window, and attached to the bottom of the bell with a magnetic coupling; if the main bell became fouled, the operator could release it, causing the bell to rise.

IN the photo above the special quartz high candle-power electric lamps are shown on either side of the diving bell. Dr. Hartman can be seen standing at the left of the diving bell in the photo above; while the photograph at the immediate left shows the diving bell being lowered into the waters of the Mediterranean. The top steel cover on the bell is bolted on, but in the newer design of bell quick-acting hand-screw clamps will be employed, the old design requiring too much time to open. In all such sub-sea work, it is imperative to be able to release the diver quickly in case he should collapse and have to be hauled to the surface.

COURAGEOUS men went to frozen poles, into tropical wilds and burning deserts in quest of knowledge. Others traced ancient culture, establishing piece by piece the earliest dawn of human civilization. The earth has now been explored and white spots on the maps have vanished.

And yet—the greatest veil lingers—a veil covering the mysteries of more than two-thirds of the globe. The depths of the oceans are still unknown. True, they have been sounded, and fragile nets brought up a few of the smallest luminous denizens of that mysterious abyss, proving that life extends far down into the greatest depths, into eternal darkness and tremendous pressure.

According to science all life began in the water. From microscopic forms in the flat shelves of the ocean it grew to gigantic types, the Saurians who probably were wiped out by the first ice-age, after some had emerged and lived on land while others went deeper and deeper during untold generations to the ocean floor. Those great depths were not affected by the ice which may have enveloped our earth for ages to be counted perhaps by many thousands of years. Are their monstrous descendants still down there and have any higher forms of life been gradually born in that unknown abyss? We do not know!

What are the obstacles in the way of exploring the ocean depths? Only pressure and darkness! Can they be surmounted by modern engineering science? Three hundred years ago the diving bell with open bottom was invented and much later diving suits; both exposing their users to the pressure of the water. Since then almost no real progress can be recorded. A few pioneers tried at the risk of life and fortune, to descend deeper with devices they invented. But they seldom found moral support, or financial

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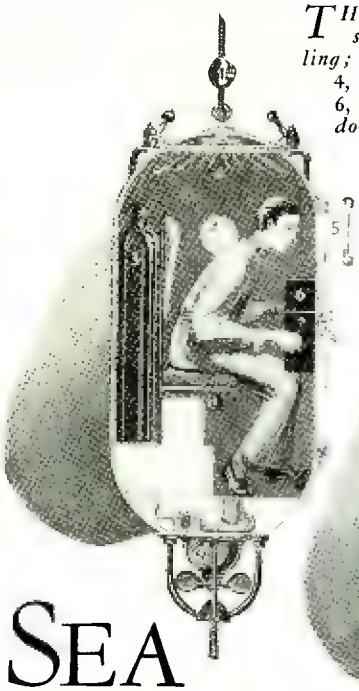
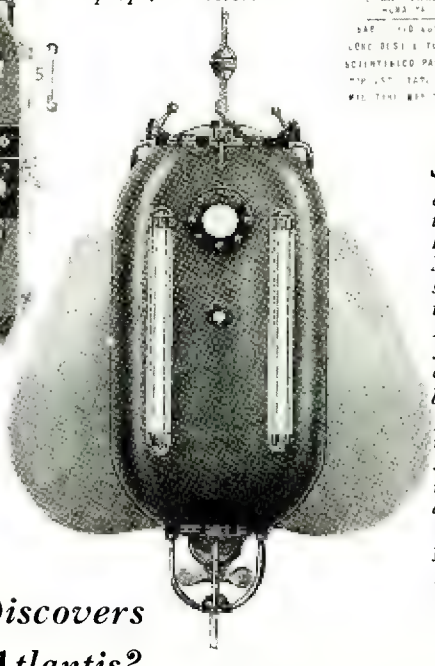
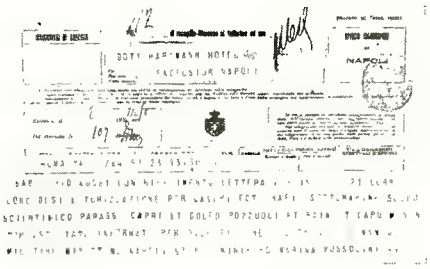


THE latest Hartman deep-sea bell: 1, magnet coupling; 2, clamps; 3, oxygen; 4, depth gauge; 5, window; 6, movie camera and window, 7; 8, air purifier; 9, propeller motor.





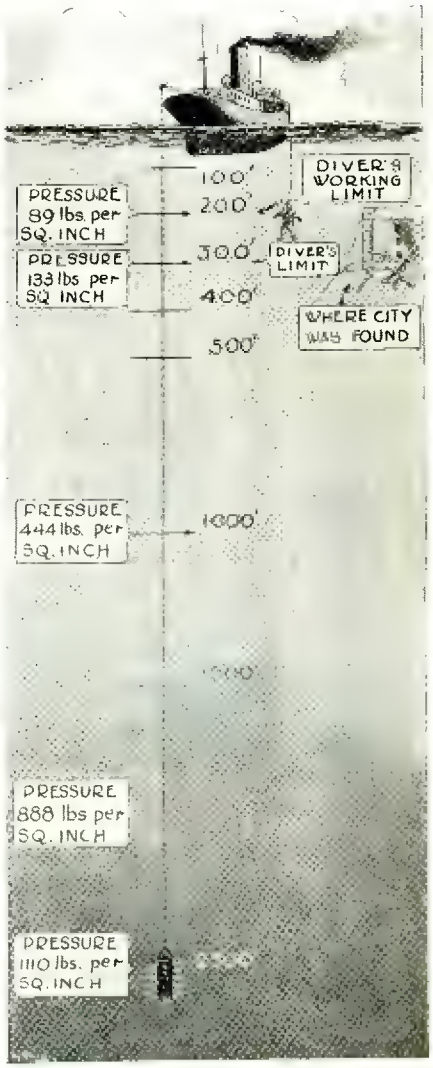
INTERESTING telegram received by Dr. Hartman from Mussolini appears at the left and reads as follows:

Dr. Hartman, Hotel Excelsior, Naples, SS Roma: Referring to your letter of the 21 of the present month, we give you authorization for submarine photographic operations for scientific purposes at Capri and the Pozzuoli Gulf, and Baia and Cape Miseno. This is by arrangement from the military authorities in Naples. Marine Minister, Mussolini.

SEA

Records and Discovers Is It the Lost Atlantis?

SOME idea of the remarkable depth obtained by Dr. Hartman in his Mediterranean sub-sea explorations with his Krupp built steel diving bell will be gained by looking at the picture at the right. Here we see that a diver reaches his limit at about 300 feet below the surface where the pressure is 133 lbs. per sq. inch.



assistance. Some were ridiculed, others lost their lives. Some inventors constructed armored diving suits, which were very dangerous due to many joints which afforded possible leakage of water. Others built hermetically closed diving chambers.

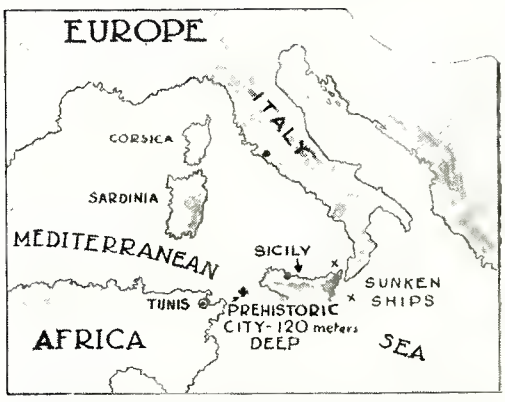
One of the later pioneers in this magnificent and virgin field is Dr. Hans Hartman, an electrical engineer of New York City, who has worked and dreamed all his life to penetrate the depths and illuminate and photograph the secrets of the sea. Already in the December number of 1916, this magazine described and illustrated his automatic deep sea camera, for which the U. S. Navy Department placed the *U. S. S. Vestal* at his disposal, to enable him to make tests and experiments. Dr. Hartman soon found that he needed a diving chamber, wherein he could accompany his camera down on its perilous way.

After several years of work following the close of the World War, Dr. Hartman had developed a deep sea diving cylinder, organized a small expedition to the Mediterranean sea, where he conducted, handicapped by limited finances, interesting research work in and around the Gulf of Naples, photographing submerged ancient ruins of Roman palaces, of the sunken city of Paleopolis and also the subaqueous arch which illuminates the famous Grotto of Capri. Premier Mussolini himself overruled obstacles made by local authorities in Naples, by telegraphing from Rome to Dr. Hartman his special permission. Europe became interested in the American submarine explorer's work (*Continued on page 738*)

The Man Who Found the Sunken Prehistoric City Off the Coast of Africa

IN conjunction with his consulting engineer, Mr. H. E. Serner, the author of the accompanying article, Dr. Hartman designed the steel cylinder shown in the accompanying pictures. The editors have inspected the final construction blue-prints made by the famous Krupp steel experts in Germany, who built the seamless steel bell used in these remarkable explorations at great depths. The Krupp built steel bell was designed to stand a pressure of 2,500 pounds or a sub-sea depth of about 5,000 feet. Dr. Hartman descended to a depth of 2,500 feet. Dr. Hartman and his colleague, Mr. Serner, deserve the highest credit for their energy and courage.

Dr. Hans Hartman has just returned from Europe and this exclusive story tells of the wonderful discoveries he has made in the Mediterranean, off the coast of Sicily.



The map reproduced above shows the point between Sicily and the coast of Africa, where the prehistoric city was discovered.

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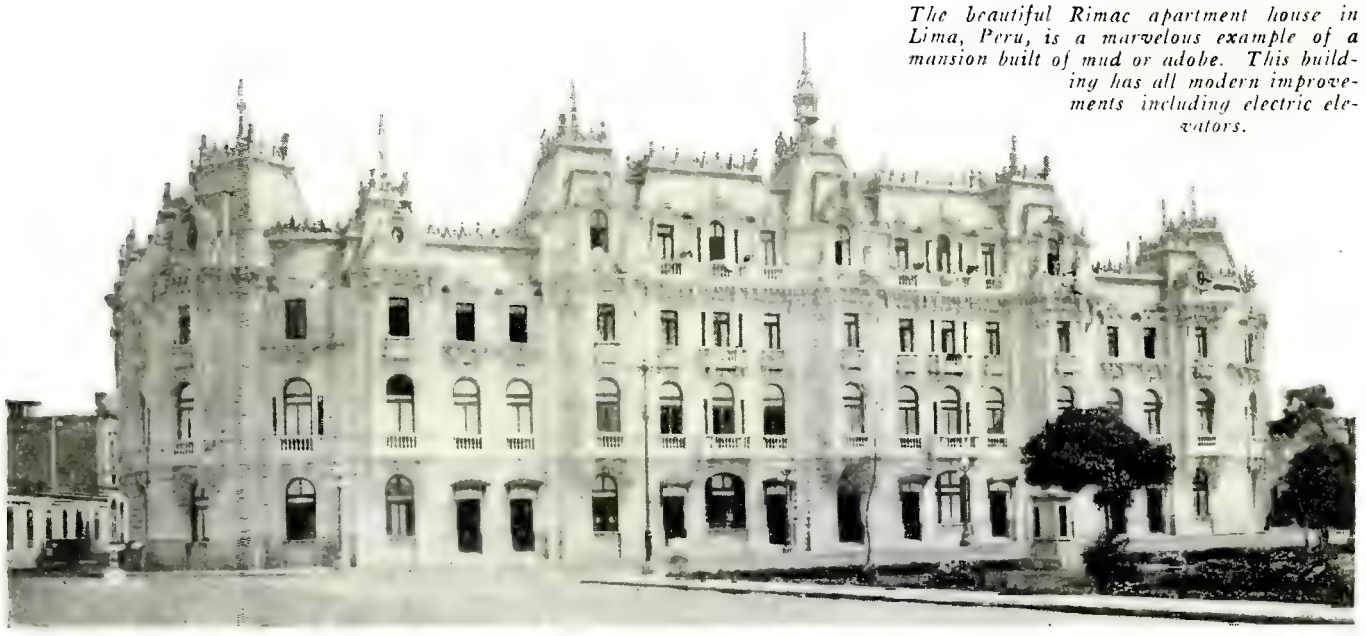


The beautiful Rimac apartment house in Lima, Peru, is a marvelous example of a mansion built of mud or adobe. This building has all modern improvements including electric elevators.

Mansions *of* Mud

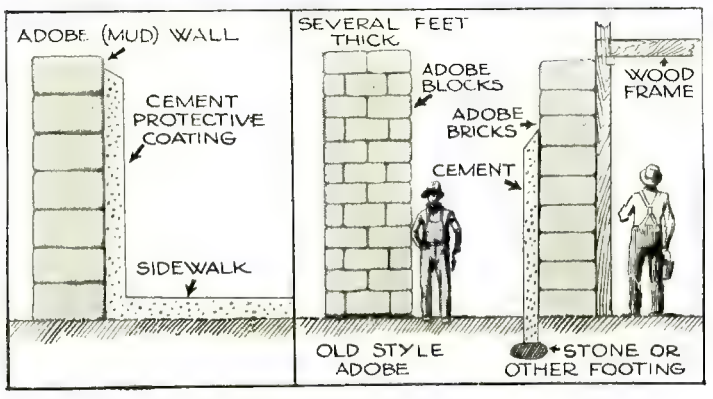
Would Be Washed Away in First Heavy Rain

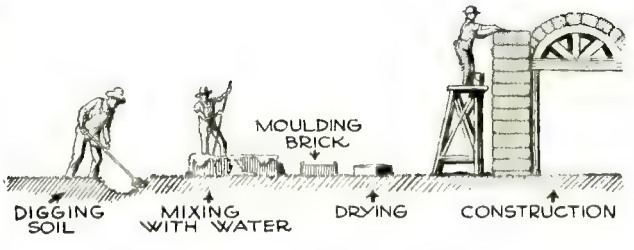
By A. Hyatt Verrill

Famous Archeologist and Tropical Explorer

THOUSANDS of years before Columbus the inhabitants of Peru built cities, palaces and temples of mud or adobe. In an almost rainless and treeless land it was the ideal material, and although deserted and exposed to the elements for countless centuries, the massive adobe walls, the immense temples and the houses of the people still remain almost intact and unaltered. The Spaniards were quick to profit by the experience of the people they conquered and destroyed and adopted adobe as the material for their own buildings. Practically every edifice of Spanish colonial times in Peru was constructed of mud, and churches, government buildings, palaces, cathedrals and forts were made of this humble material. These earlier mud buildings were constructed by the simple process of piling large adobe bricks or blocks one upon another to form the walls, and in order to support the weight of heavy timbers, floors and roofs, these walls were of necessity enormously thick and massive. Moreover, there was a limit to the height to which such walls could safely be carried. The weight of the adobe itself was enormous, and its resistance to a crushing strain is not very great, and as a result most of the earlier adobe buildings were low and seldom more than two stories in height. Occasionally, however, very imposing buildings were erected, and the great cathedral in Lima is (*Continued on page* 736)

Above we see a glorious medieval castle in Peru, all built from mud or adobe. The method of making adobe construction is shown below. At right: Another handsome home of a wealthy Peruvian—and it's all made of mud!





Beginning at the extreme left, the lower row of pictures show mud or adobe wall with a cement coating to protect it against rain spatter; comparison of old-style adobe wall with thinner new style, which utilizes a wood frame; and, above, various stages in adobe construction.

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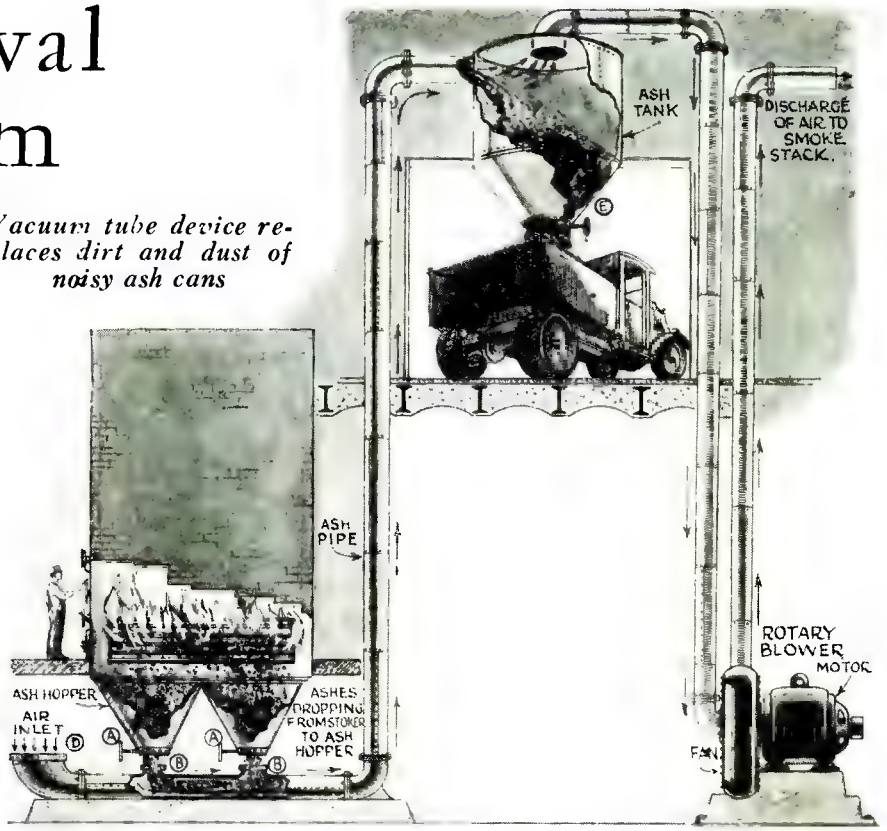
Ash Removal by Vacuum

Vacuum tube device replaces dirt and dust of noisy ash cans

ONE of the most novel and efficient means for the removal of ashes has recently been installed in the new mammoth New York Life Insurance Building.

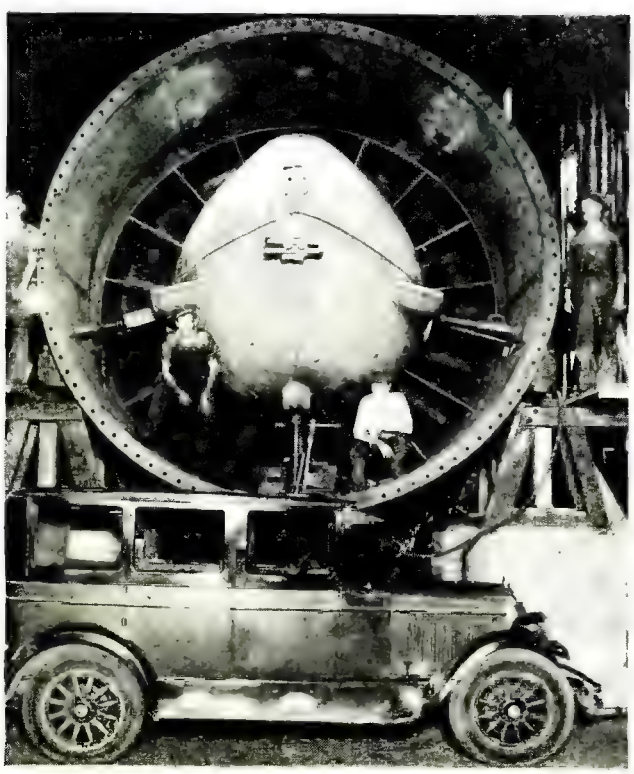
The ash-removal plant operates in the following manner. The rotary blower motor, at the right, is started, and the air is allowed to filter in through the air inlet at the extreme left. This air is forced by the blower through the ash pipe and the ash tank to the smoke stack, where it is discharged to the outer atmosphere. The plug "B" is now removed from under the hopper to be emptied. Then a large square gate at "A," on the bottom of the hopper is opened and the ashes are fed into the ash pipe. The velocity of the air at points "B" and "D" is sufficient to carry the ashes up to the ash tank, one hundred feet higher. The ashes fall to the bottom of the tank while the air passes out as mentioned before. The ash man arrives, backs his truck under the tank, makes sure the blower is not working, and then proceeds to open gate "E." The ashes fall into his truck, and after it is loaded, he closes the gate and the tank is ready to receive more ashes.



Above is a complete schematic diagram of the vacuum ash-remover. This drawing shows only two of the five boilers operated under this system. The hot ashes drop into the hopper and are conveyed up the ash-pipe.

Pumps to Empty Rain-Filled Streets

TO drain accumulated rain water from the streets of New Orleans, which is below sea level, that city has installed seven new mammoth pumps, with a capacity of 25,000 to 28,000 cubic feet of water per second.



One of the huge pumps, motored by General Electric, which will aid drainage of New Orleans streets.

Model Plane Sets Endurance Record

NOT content with reading about endurance records for airflights, the air-minded youth of the country set out to make juvenile history in the recent National Miniature Aircraft Tournament at Glendale, Cal. Boys of all ages, 250 in number, competed in this meet, with models of planes of standard design, to prove to the world that they were vitally interested in aviation. All the planes used were scale models of famous planes, ranging from copies of the well-known Curtiss-Hawk to the intricate Byrd-Fokker plane. The contest was won by Cecil Schwartz, who managed to keep his tiny plane in the air for a period of eight minutes and 44 seconds. This is really remarkable, when one considers that the only means of propulsion on these planes were spring motors and rubber bands. Compressed air engines should prove effective.

Above is John Bratten with the working model of his Curtiss-Hawk plane, which won first place.

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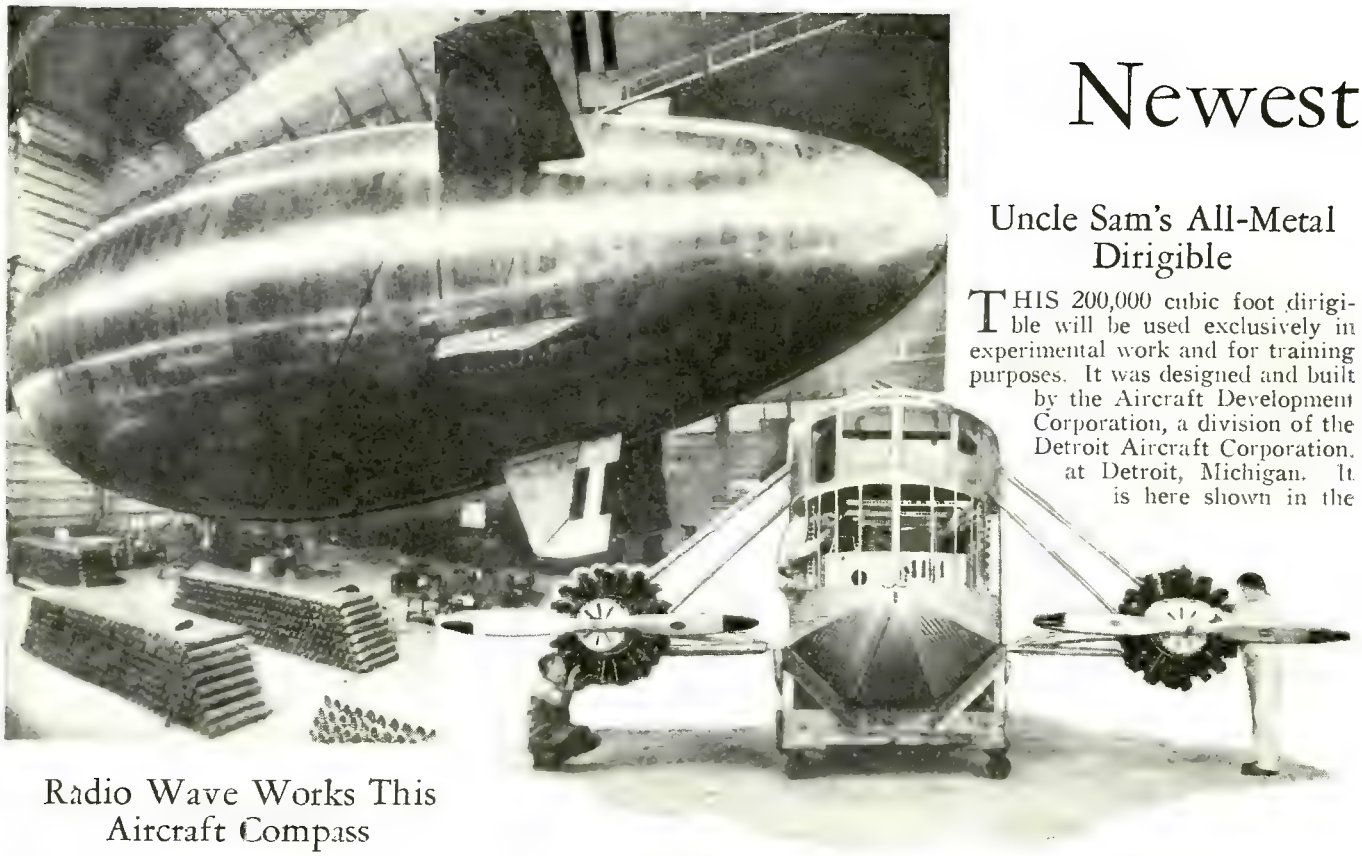
Newest

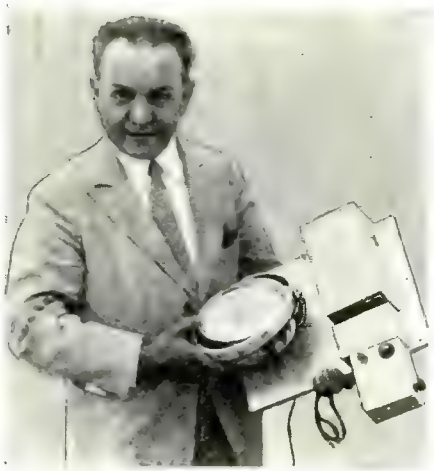


Uncle Sam's All-Metal Dirigible

THIS 200,000 cubic foot dirigible will be used exclusively in experimental work and for training purposes. It was designed and built by the Aircraft Development Corporation, a division of the Detroit Aircraft Corporation, at Detroit, Michigan. It is here shown in the hangar in the process of construction, with the control car not yet in position. The gondola illustrated below has two Wright J-5 motors developing 440 horsepower. Observe the unique construction of the control fins.

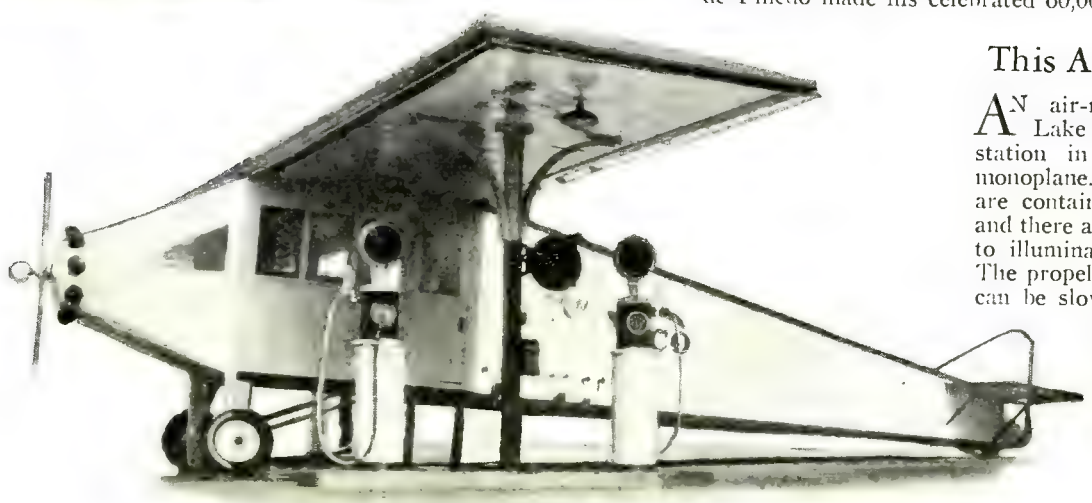
Radio Wave Works This Aircraft Compass

THIS photograph shows William Dubilier with the Eadon Automatic Direction Indicator. This device continues to point its needle in the direction of the broadcasting station to which it is tuned. If the apparatus is set in a plane and the plane should hover above the broadcasting station, the needle will point directly down to the ground. This indicator has been sold to the government and will be available to foreign governments and private organizations. It will be of service in foggy weather and at night time to guide the aviator to land.



Double Hull Seaplane

THE American Savoia-Marchetti double hull seaplane has two 500 horsepower motors in tandem. It will carry 14 passengers at a speed of 128 miles per hour, with a 5,500 pound load. This is the type of plane in which Commander de Pinedo made his celebrated 60,000 mile flight.



This Airplane Can't Fly

AN air-minded citizen in Salt Lake City built this gasoline station in the form of a large monoplane. Accessories and parts are contained within the structure and there are lights under the wings to illuminate the ground at night. The propeller in front of the plane can be slowly revolved by a small motor. On the side of the airplane fuselage one can see a group of spigots where oil is dispensed. The wing serves as an awning.

Photo Ewing Galloway

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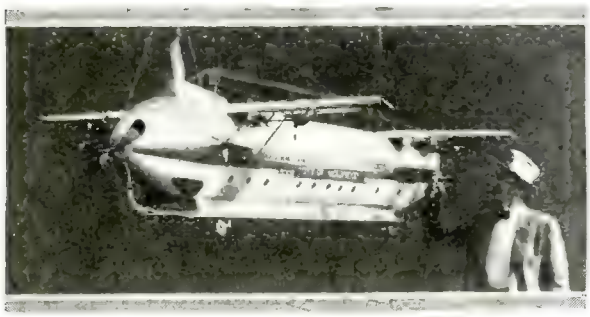
Aviation Ideas

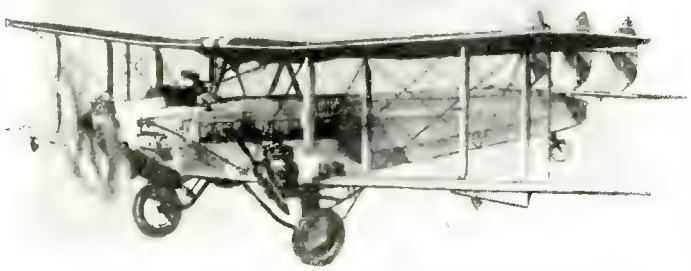
World's Smallest Flying Machine

THIS biplane is powered by a one horsepower motor. Flight is very limited, lasting but a few yards, and the plane rises but a few feet in the air. It was built in Rome, Italy, for this child, who appears to be a flying enthusiast.



A Monoplane-Dirigible

A REPLICA of a rigid metal-covered ship which Captain W. F. Cooper, of Hollywood, California, intends shall be 780 feet long. Seven motors are to be used to drive it, and its estimated load is 125 passengers and a crew of 25. The vessel will glide on water.



When One Motor Goes Dead

HERE is a striking photo of a three-motored De Haviland Hercules plane with three engines, totaling 1,500 horsepower, demonstrating its ability to fly on any two engines. This type of plane is used by the Western Australia airways on a portion of the route from London to India, and in particular on the section from Cairo to India. A performance of this nature makes a forced landing on the desert a remote possibility.

Caterpillars Going Down!

THESE men are training for future membership in the Caterpillar Club, the organization of fliers whose lives have been saved by parachutes. Note that one of them is descending head first. The picture was taken at San Antonio, Texas.

Shot-Gun Shell Starts Engine

CHARLES A. LEVINE is sponsoring a new type of starter for airplane engines which uses a half length 12 gauge shotgun shell to supply the starting force. The starter weighs only 4 pounds and is screwed into the spark plug opening of a cylinder, after discharge the spark plug is replaced. The shell is inserted in the starter and fired. There is no noise when the shell is discharged.

Screws Its Way Through the Air

HERE is a skeleton frame-work of the Airworm, a new type of aircraft previously illustrated in this publication. The "barrel" turns and the large worm on the outside propels it. No extensive flights have been made with it.

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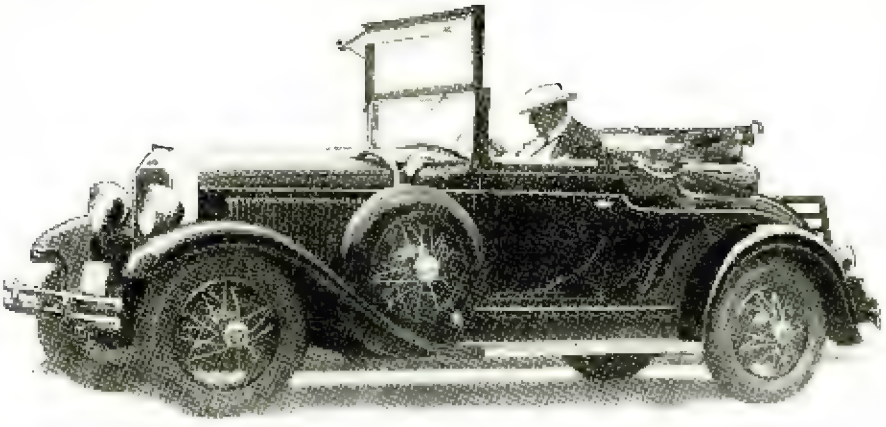
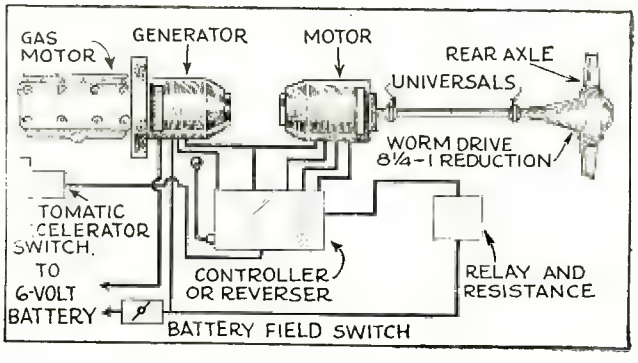
Gas-Electric Auto Has No Gear Shift



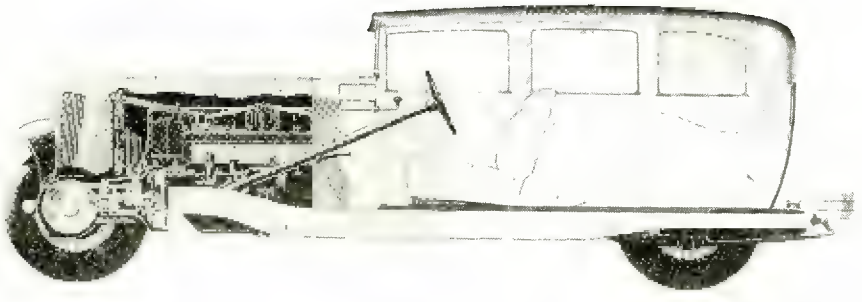


A NEW type of gas-electric automobile built in this country was recently purchased by Col. E. H. R. Green, son of the late Hetty Green, world's richest woman. This car, equipped with a new type drive, operates without a transmission, clutch pedal or gear shift. As shown in the diagram, a standard auto engine under the hood drives a generator. Current here produced operates a motor with shaft geared to the rear axle. The photograph shows Col. Green in the car. Note that the windshield is double, so that the owner can get into the car without stooping over. This Stearns-Knight car was built at the Rauch & Lang plant, in conjunction with the General Electric Company experts.

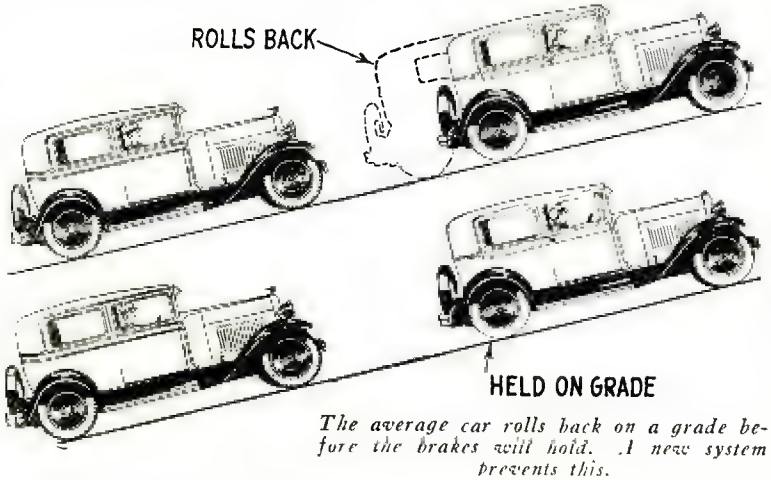
This Car Is Pulled Instead of Pushed

Front Wheel Drive Presents Many Advantages

THE new automobiles are going to be front-wheel drive, if one can interpret the trend by examining the newest models made by leading manufacturers such as the Cord here shown. This pulling traction instead of a pushing effect provides many advantages. The driving force is always applied in the same direction of motion. This reduces the likelihood of skidding. There is also a reduced thrust on front-wheel bearings. The body can be lowered, reducing wind resistance and providing greater roadability. The front wheel drive also lessens vibration because the long drive shaft has been eliminated.

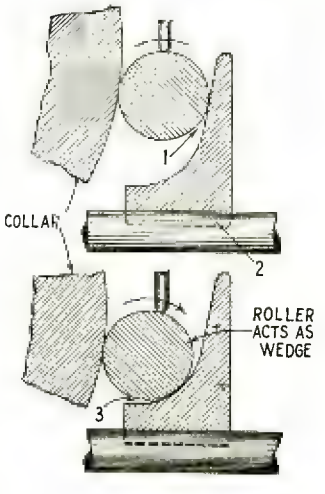


No More Sliding Back on Hills



The average car rolls back on a grade before the brakes will hold. A new system prevents this.

A NEW system, which can be applied to any car as an added unit or as an integral part of the transmission, prevents back rolling regardless of whether the shift lever is in neutral position or in any forward position. It is released when the lever is put in reverse. Diagram explains how it works. Collar is attached to drive shaft.



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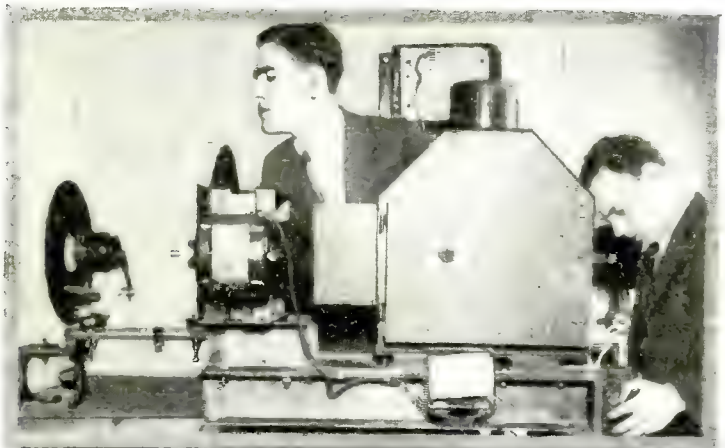
Baird's *Newest* Televisor

Designed to bring "Talking Movies" into your home

By H. Winfield Secor

VOICE and facial image were simultaneously flashed over the wires by means of the newest Baird experimental television system recently, in a demonstration to an audience of newspapermen given in New York City. The presentation was carried out under the direction (*Continued on page 732*)



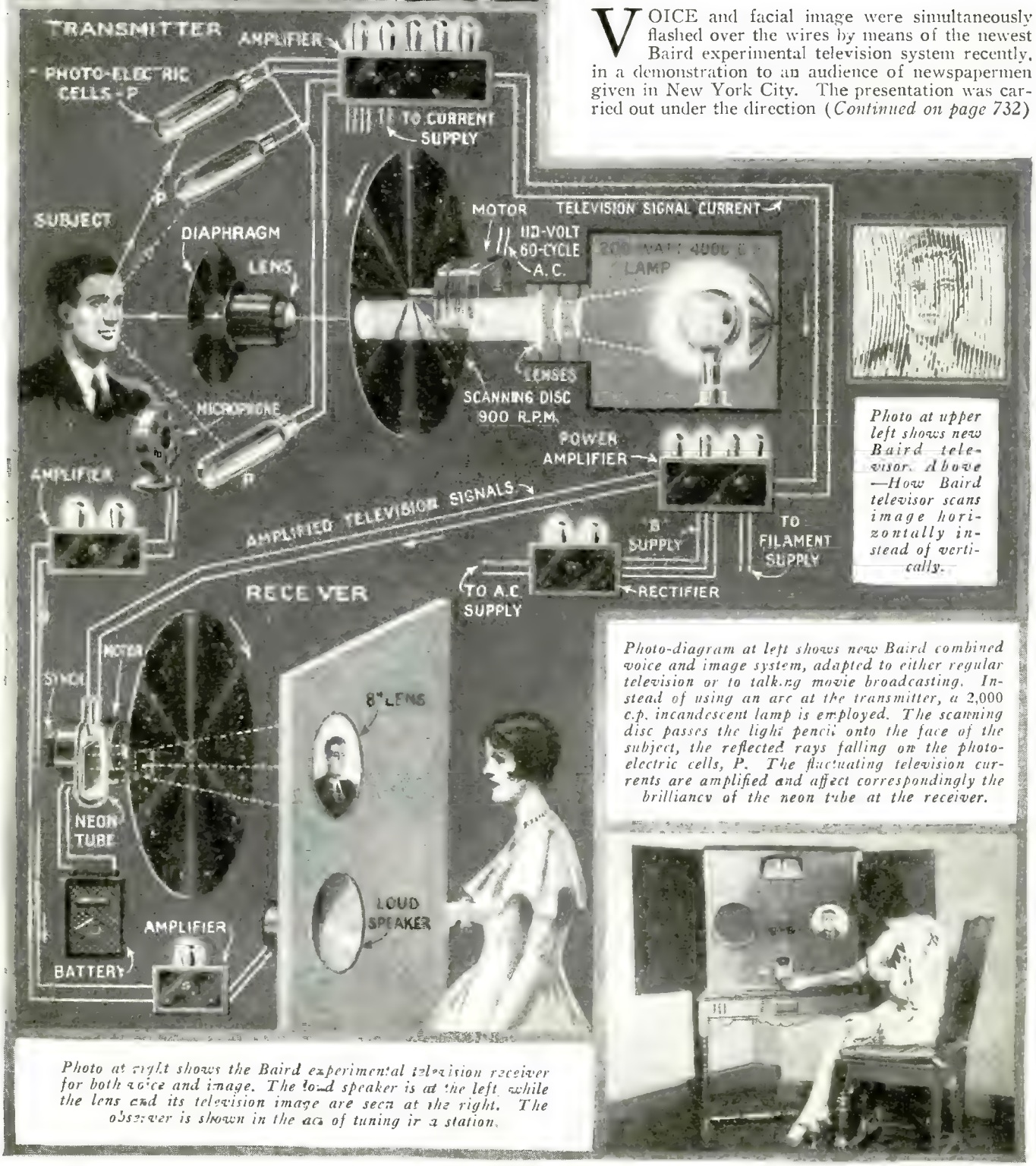


Photo at upper left shows new Baird televisor. Above —How Baird televisor scans image horizontally instead of vertically.

Photo-diagram at left shows new Baird combined voice and image system, adapted to either regular television or to talking movie broadcasting. Instead of using an arc at the transmitter, a 2,000 c.p. incandescent lamp is employed. The scanning disc passes the light pencil onto the face of the subject, the reflected rays falling on the photo-electric cells, P. The fluctuating television currents are amplified and affect correspondingly the brilliancy of the neon tube at the receiver.

Photo at right shows the Baird experimental television receiver for both voice and image. The loud speaker is at the left, while the lens and its television image are seen at the right. The observer is shown in the act of tuning in a station.

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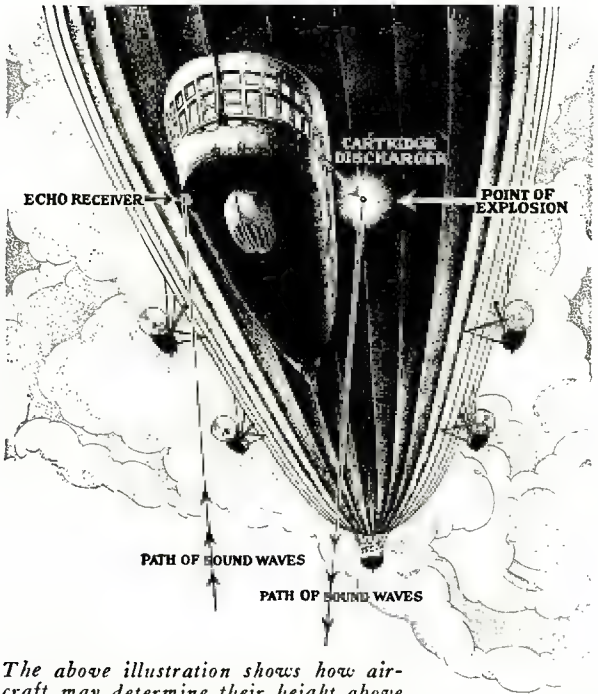
Measuring Heights *and* Depths *with* Sound

By Botho vŏn Romer

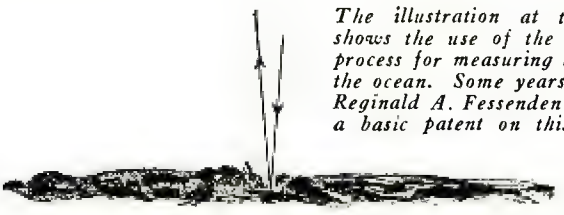


The above illustration shows how aircraft may determine their height above the ground by means of an echo measurement system. The sound reproducer is fastened to the fuselage from which the cartridge is discharged. The sound waves go to the surface of the earth, as shown below, and are reflected back to the craft.

FORMERLY the measuring of the depths of the sea was restricted to the seaman's lead with its measured rope or wire. In the most modern times an entirely new method for measuring depths has been developed. The system of echo measurement here described is that devised by the well-known physicist Behm, who, after lengthy research, has succeeded in bringing his experiments to a brilliant and successful conclusion. The illustration appearing here shows how the sounding process is used for measuring depths. The solution of the echo-sounding problem was obtained when Behm used the damping agency, which the hull of the ship provides, to prevent the echo receiver from being affected by the direct action of the sound signals when they are discharged on the other side of the ship.

On one side of the ship, by means of a cartridge, an explosion signal is given, through which agency it is quite possible to measure slight depths of the channel. After the cartridge is released, an explosion occurs when it has penetrated 3 to 6 feet below the surface of the water. The sound waves which are first received by the so-called discharge receiver go down through the water until they reach the bottom and are then reflected back to act upon the echo receiver.

By means of a time-measuring device, the interval from the starting of the sound waves, after the cartridge has exploded, until the sound wave is received by the echo receiver, can be measured accurately and produces a visible record. The exact time which has intervened can then be read off on a scale, which may either be used for depth measurements or for height measurements.



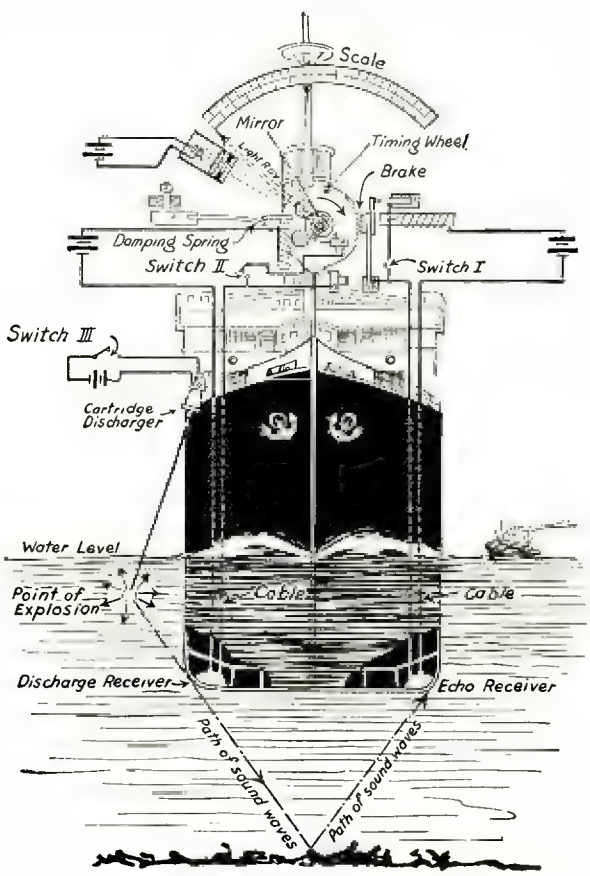
The illustration at the right shows the use of the sounding process for measuring depths in the ocean. Some years ago Dr. Reginald A. Fessenden obtained a basic patent on this system.

When the measuring system is to be used by a dirigible or airplane, the sound producer is fastened to the fuselage from which the cartridge is discharged. The point of explosion is thus clearly defined. The sound waves go down to the surface of the earth and are reflected back to the echo receiver. Behm has succeeded in measuring heights in airplanes using this method which gives an extraordinarily rapid estimation of the height of the elevation of the airplane or dirigible within an accuracy of about one foot.

Measuring by Radio

FOR the last five or six years the United States Coast and Geodetic Survey have employed a method called "Radio Acoustic Ranging." It is used to determine exactly the position of the survey ship during hazy or foggy weather or when the ship is out of sight of land. The purpose of the survey is to chart the coast lines at regular intervals out to a certain depth. In using the radio method there are two shore stations set out by the ship about 35 miles apart. Each of these is equipped with a radio transmitter, receiver and a three-stage bomb audio amplifier. About a thousand yards off shore is a box containing three hydrophones. At a given signal a bomb is dropped overboard from the ship and the exact time and log reading are taken at that instant.

In the ship's radio shack is a chronograph which records seconds with one pen and under-water sounds and radio signals with another pen. As the bomb explodes, the chronograph pen makes a dash on a tape. (*Continued on page 757*)



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Gotham Plans *New Tunnel*

Above, diagram of the proposed tri-borough tunnel, showing various exits to New York's main traffic arteries. Left to right, cross-section of twin tunnels under East River.

NEW YORK has seen in the rapid growth of the automobile merely one more transportation problem. The task of keeping commercial and pleasure traffic moving has been the greatest dilemma the city fathers have been faced with in some time.

To aid in the solution of this commercial conundrum, a new tri-borough tunnel has been proposed, which will link the boroughs of Queens and Brooklyn with Manhattan. This tube will be similar in construction to the Holland Vehicular Tunnel, which connects New Jersey with New York, except that it will be larger and embody several improvements. One of these improvements is the proposed double-decked tube under Manhattan. It will consist of twin-tubes passing under the East River and having numerous exits in all three boroughs. In Manhattan it will be connected with all the main arteries of traffic, passing up 38th Street to Lexington, Fourth and Fifth Avenues, and in Queens and Brooklyn it will have one main exit leading to a strategic point of distribution.

This tunnel, in spite of its high proposed cost ($100,000,000), has been looked upon with much favor and with serious thought on account of the huge success of the Vehicular Tunnel under the Hudson River. Its capacity will be 4,000 vehicles per hour, which is 200 more than that of the Holland Tunnel. It will provide an easily accessible outlet for the large amount of traffic which daily plies between these home boroughs and the business borough of Manhattan.

New Ways to Detect *Icebergs*

By Dr. Howard T. Barnes
McGill University

I HAVE recently returned from an Iceberg Expedition, which was made for the express purpose of finding some method of detecting icebergs by means of illumination. As the use of searchlights has been abandoned, since the fog reflects back the light and blinds the eyes of those on the bridge, it was my hope to develop some powerful lights which could be thrown sufficiently far ahead of a ship, to enable the light to penetrate the fog and silhouette the iceberg. In case the fog was too dense, it was my intention to adapt a photo-electric cell sensitive to the infra-red rays; so that the shadow of the iceberg could be made audible, through one or two stages of amplification. We used parachute flares, but they do not seem practical, as they are too much at the mercy of the four winds of heaven. Fortunately I was able to stumble upon a simple method of detecting icebergs by using a low-pitched submarine microphone, which gave loud and distinct sounds of the melting iceberg six miles away. Temperature changes are also noted in the water at considerable distances.

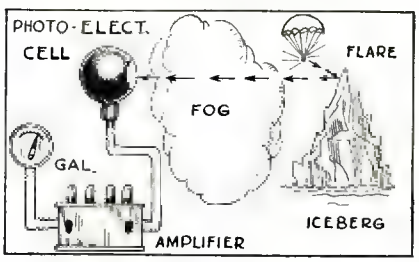

Diagram showing parachute flare and light effect on photo-electric cell.

At left, submerged microphone which picked up sounds of melting iceberg six miles away.

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40,000 Horse-Power From a 3-Foot Pipe

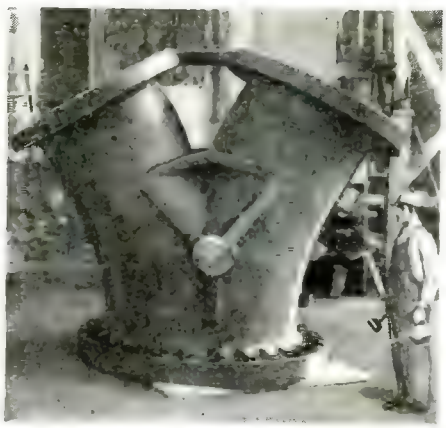
By Charles W. Geiger

HIGH-HEAD water-driven electric power plants are no novelty on the Pacific Coast, and particularly in California, where the rapid fall of numerous mountain streams makes it possible to develop unusually high heads without long conduits. The Ducks Creek hydro-electric power plant of the Feather River Power Company, recently placed in operation in Plumas County, California, is designed to operate under a maximum static head of 2,562 feet, making this the highest head hydro-electric development in North America. How long this new plant will hold this record is a question, for the advance in hydro-electric development is so rapid that today's wonder may be tomorrow's commonplace.

An interesting feature of the Ducks Creek development is the system of remote indication and control which has been devised. By means of polarized relays, the opening and closing of the valves at the reservoirs and intakes to the tunnels are operated from the power house. Also, it is possible for the operator to select any one of ten valve positions at the main storage reservoir and upper diversion tunnel, or two positions at the intake to the lower tunnel. The operator can read from his operating board the position at which any valve is set. In addition to this, the water level at any moment in either of the reservoirs is indicated and also recorded in the power house. Through this system a flexibility of operation is attained which would otherwise be impossible.

The average slope for the 4,800-foot penstock is 30 degrees. The plant generates 40,000 horsepower. This is the highest head hydro-electric project in North America. Such high heads produce high pressures, necessitating the unique design of apparatus.

Above is shown a photo of the pipe line and power station. The photograph at the right shows two 40,000-HP. Pelton double, overhung impulse turbines and one G. E. generator turbine, operating under a 2,350-foot effective head. Water-power plants of this type show an over-all efficiency about five times greater than plants using (coal) steam power.



The "Y" pipe supplied for use where the two water penstocks branch out. There are two of these large pipes supplied for each of the turbines; note man.

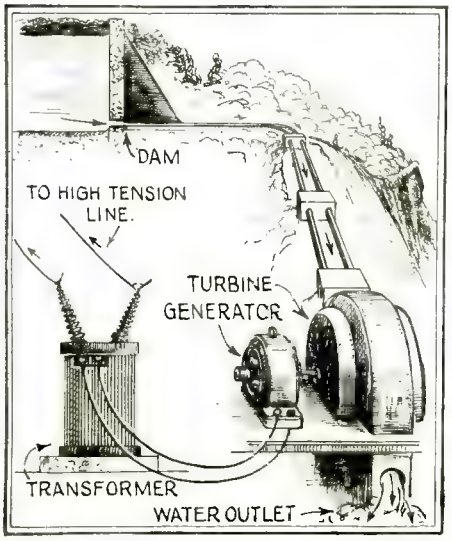
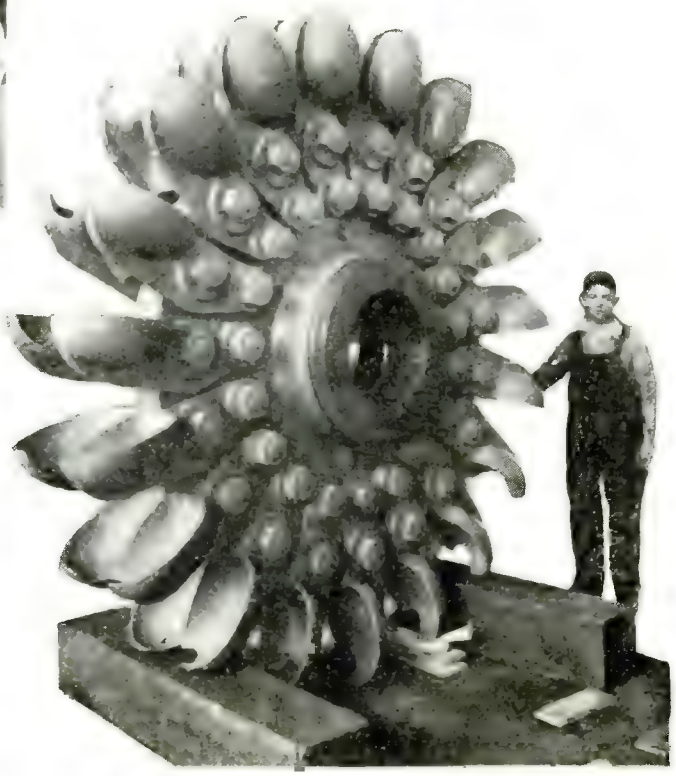


Diagram showing how power is generated at a water-power electric plant. The water runs down the double penstock, drives the turbine and electric generator; transformer raises the voltage.



At the right is shown the Pelton overhung impulse turbine wheel, built for operation under the highest head in America. This wheel is of unique construction and design.

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Would You Believe It?

Truths Stranger Than Fiction Are Here Photographically Presented

A Mysterious Head

AT first glance this might be the face of some unusual stage character with a very prominent chin. However, as you examine it closer, you wonder what the two extensions in back of the head might be. There now, we have given the secret away. It is a head, but that of a male beetle with very unique horns. There is little reason for these horns, because the beetle is quite harmless. Like all other beetles, this one will fly against a light. Only the head alone has been photographed, the body having been blocked out by the artist.

Yes, Colored Girls Do Blush

THIS colored girl is a member of the "Hot Chocolate" Company and her blushes (the rush of blood to the face causes a minute rise in heat) are being detected by a heat-sensitive instrument held in the hand of Mr. E. E. Fairbanks, of the Museum of Peaceful Arts. This instrument measures very slight changes in temperature. The results disclosed that a white girl has better control over her blush and a colored girl at times will outblush the whitest girl in the land. Too bad the blushes can't be seen.

Does Land Sink?

HERE is an actual photograph of what was once a perfectly level prairie. This began to sink, and within three days it dropped 75 feet, leaving sheer walls. The former level prairie

land, still unbroken, was at the bottom of the cavity. This event caused no small amount of excitement when the residents of Danvers, Montana, where this happened, learned of the fact. Geologists state that a "fault" probably existed at this point, or else the land dropped down into the bed of a subterranean river.

Who Said "Pucker Your Lips"?

THE lips of this belle of the Sara people in Africa measure 6 inches in length. According to the people of this tribe, such distortion of the lips is a sign of beauty. Openings are cut in the upper and lower lip and pegs of wood inserted. These wooden pieces are repeatedly removed and larger ones substituted until this pelican-like mouth results.

This Tiger Made of ??

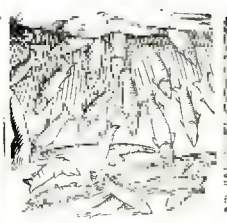
MR. FIEVET is very good at stamping other things than his feet. As a matter of fact, he used over 50,000 stamps and took over 3,000 hours to complete this tiger head. Postage stamps of different countries were cut up and glued down to give this faithful reproduction of a tiger.

Dry "Whiskey" Has Strong Kick

A PLANT with a name like Lophocereus Williamsii might be responsible for anything. This plant is also known under the name of Peyote, a species of cactus. Mexican Indians treat it and then chew it, thereby getting a better jag than from the poorest grades of moonshine. Miss Mary Jo Baird is seen holding samples of Peyote buttons.

When It Rains Fish, Worms and Frogs

By Richard H. Tingley, C.E.



ALMOST any year one may read in the dailies that, somewhere in the world, frogs, toads, fishes, sea-turtles and the like have rained down from the clouds. Most people think such accounts are just newspaper yarns and don't believe a word of it. I used to be that way myself until I saw it rain thousands of little perch and bullpouts at Providence, R. I., in 1900. Then I investigated and found at least two hundred accounts (*Continued on page 761*)

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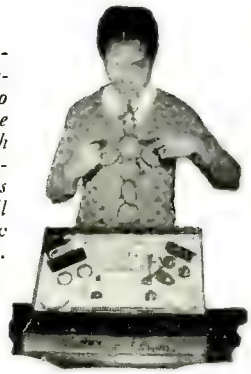
Dirigible Construction Set

THIS photograph shows a dirigible that has been constructed from small metal girders. These girders are all assembled by means of small bolts and after the framework has been completely built, the dirigible is covered with cloth. The gondolas are then added, the propellers fitted. By directing the air from a fan against this model, the propellers will be seen to whirl realistically. The model is more than four feet long.

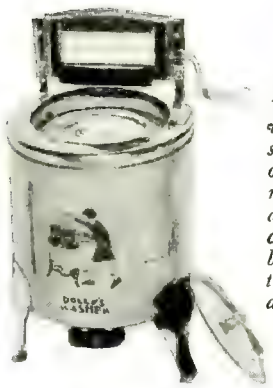
Hydroplane

THE hydroplane below is constructed entirely of wood. Beneath the top wing there are two small spring motors which can be wound up with a key and which operate the propellers. The propellers will run several minutes with one winding. The device will not fly, but makes an entirely new water toy that will be well received.



Magical Outfit

MAGIC appeals to the youngster just as it does to a person of maturer years. An enterprising American manufacturer has placed several magical kits on the market to meet the pocketbook of the everyday man. The tricks are well chosen and the set so arranged that no effect in outfit 1 is duplicated in set 2 or 3.



Dolly's Clothes Washer

ALTHOUGH this is a miniature clothes washer, it will act the same as large electric ones. A powerful spring motor drives the device and whirls the clothes-containing receptacle back and forth, lashing the water into foam and washing dolly's things. The wringer automatically applies itself to varying thicknesses of material run through it. The rollers are covered with the conventional rubber.

Destroyer

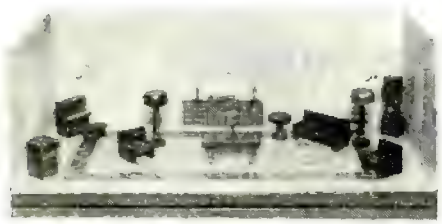
THE destroyer below is made of wood and equipped with turrets and guns. It is operated by a spring motor. As can be seen by comparison with the ruler, it is more than 2 feet long. Wheels are provided so that the toy does not lose its usefulness as an indoor or outdoor plaything.

New that Delight

Especially Selected for Priced within the

Miniature Doll House

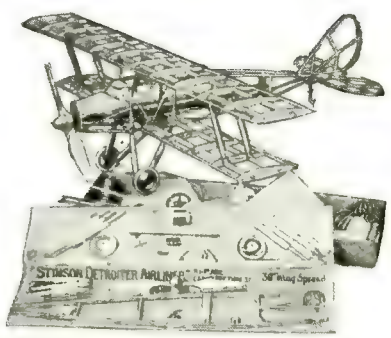
ALL of the furnishings in this living room suite are made entirely of wood. Each article is a replica of the full-size model. Some of the items are double-faced, as for instance the radio cabinet in the left foreground which can be turned around so as to represent a phonograph. The child can get much amusement rearranging rooms. Other rooms are available.



Electric Auto

THE auto below is powered by an electric motor. It will travel against the fence, from which it receives its power, at a high rate of speed. The front wheels always have a tendency to turn the machine in towards the rails. The track can be changed in shape or form so as to produce breath-taking curves. The device is very well constructed and the track itself is made in but two sections so that it can be quickly taken apart.

Flying Airplane Model



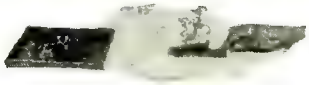
THIS Stinson Detroiter air liner can be built from model parts by the average boy. The plane has a wing spread of 36 inches, and when properly constructed, it will actually fly. Note the perfection of the skeleton construction indicated in the photograph.

Windmill Pump

THE variable speed gear and windmill pump shown here are two new acquisitions to the toy field. When belted to a motor the windmill turns and the pump actually pumps the same water over and over again. Both novelties are beautifully finished.

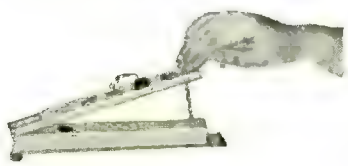
Lassoing Cows

IN the 50c game below, the object is to lasso the metal cows by pressing on a lever, causing the rider to toss a metal ring. The game seems quite easy, but you do not think so after you once try it.



Skipping Game

THIS inexpensive item requires considerable skill for its proper manipulation. A marble is put in the socket at the top, the lever pressed down, and then released. The marble is supposed to hop from one opening into another.



Names and addresses of manufacturers furnished upon request.

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Toys will the Kiddies

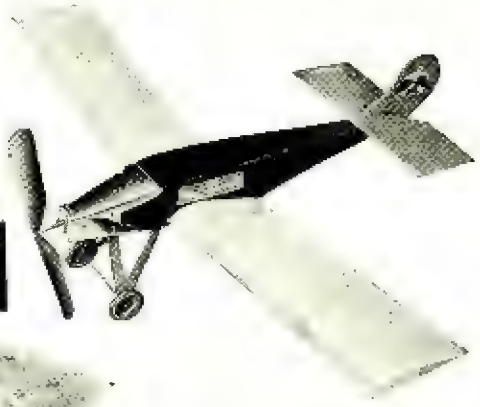
Novelty and Uniqueness average man's means

Saxophone

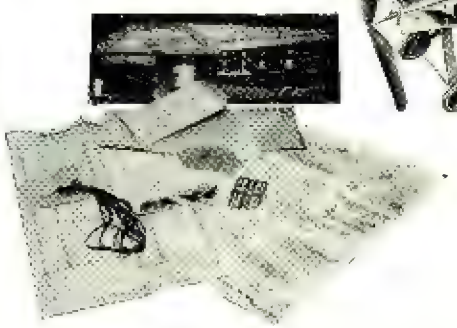
ANY child can play this saxophone. One does not however have to suppose that this instrument is of the ordinary wood variety. The construction here is beautifully nickel-plated and the bell is handsomely finished. There are enough keys present to enable one to play complete melodies and the reeds are of true tone.

Monoplane

THE illustration at the right shows a monoplane built of parts easily available on the market today. This monoplane has been noted for its long flights.



THE construction parts for making the airplane are shown at the left. This model is made largely of balsa wood, has indestructible landing gear, aluminum cowling and wheels. Of course it is inexpensive.



Sewing Machine

THE sewing machine below will do practically anything that mother's machine can do. As a matter of fact, mothers find it convenient to sew on it because it is so portable. . The needle is protected to prevent injury.

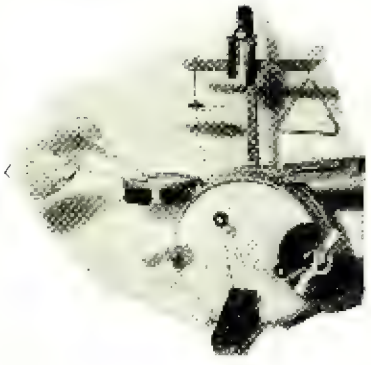
The toy sewing machine here illustrated is operated in simple fashion by rotating the wheel at the right of the machine. A spool of thread is placed on top of the machine and the thread is then led through a tension device, thence through several guides down to the needle.

Electric Range

ONE of the best constructed, most reasonably priced electric ranges that will actually work, which the editors have ever seen. Compare size with plug in foreground.

Miniature Drum Set

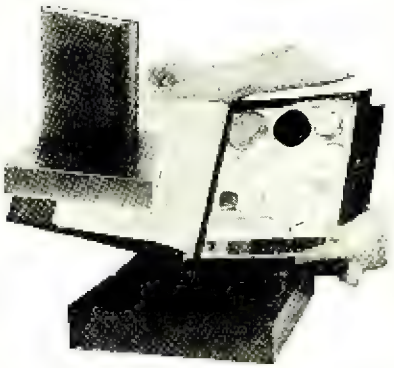
THIS complete set of drums is bound to delight the youngster, but the racket will probably not please Dad if he is trying to take an afternoon nap. The bass-drum measures 11 inches in diameter.



Model Architecture

IN new architectural construction sets, realistic reproductions of homes are now possible with materials the same as used in actual building operations. All parts are cut to size and shape. The doors and windows are complete with frames, just like .in real homes, and covering material such as stucco, etc., is furnished ready to apply in plastic form. Chimneys, driveways, sidewalks, shrubbery also come with the outfits.

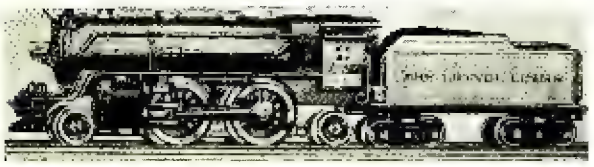
Telephone Book



THE story of the telephone is only a portion of this outfit gotten up in book form. The remainder consists of materials for building a telephone, even including the battery.

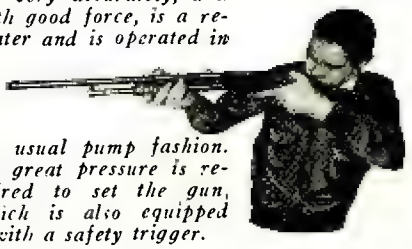
Electric Locomotive

THE locomotive shown in the photograph below is driven by a powerful electric motor. Nevertheless, the article faithfully reproduces some of our larger steam locomotives. Of course, the pistons move back and forth and the fittings are realistic throughout.



Pump Air Rifle

THIS air rifle shoots very accurately, and with good force, is a repeater and is operated in the usual pump fashion. No great pressure is required to set the gun, which is also equipped with a safety trigger.



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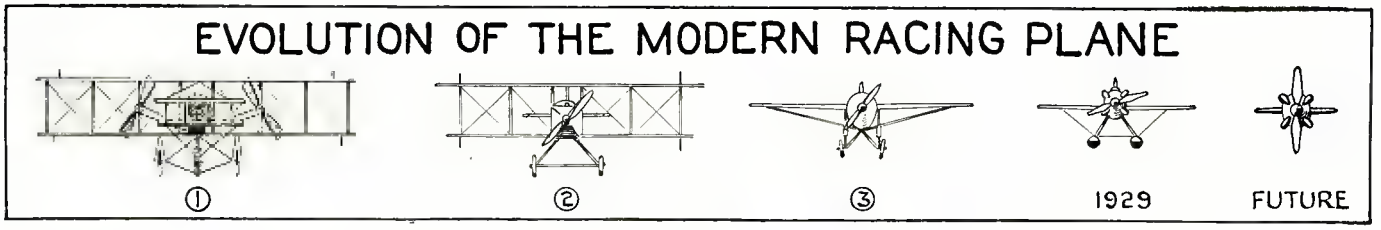
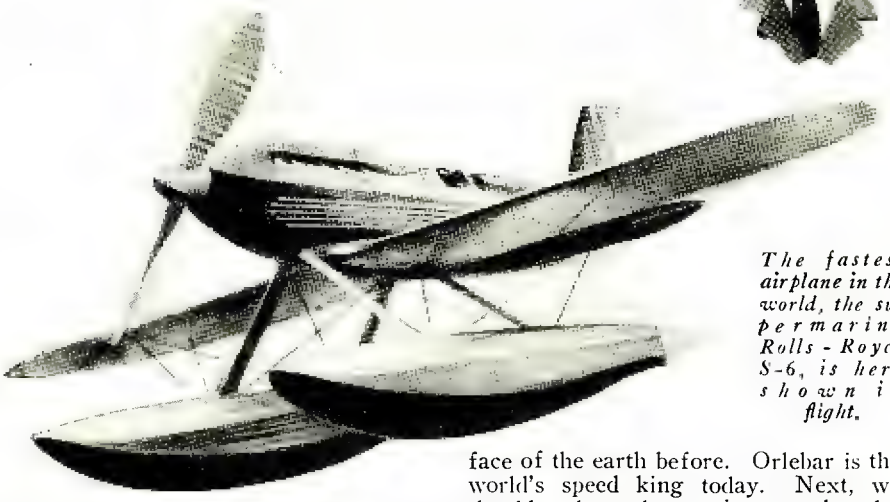


Six Miles A Minute!

Orlebar
The Man Who Did It

The smiling face of Augustus H. Orlebar, who smashed all world speed records for any kind of craft when he flew his supermarine Rolls-Royce S-6 at an average speed of 357.7 miles per hour.

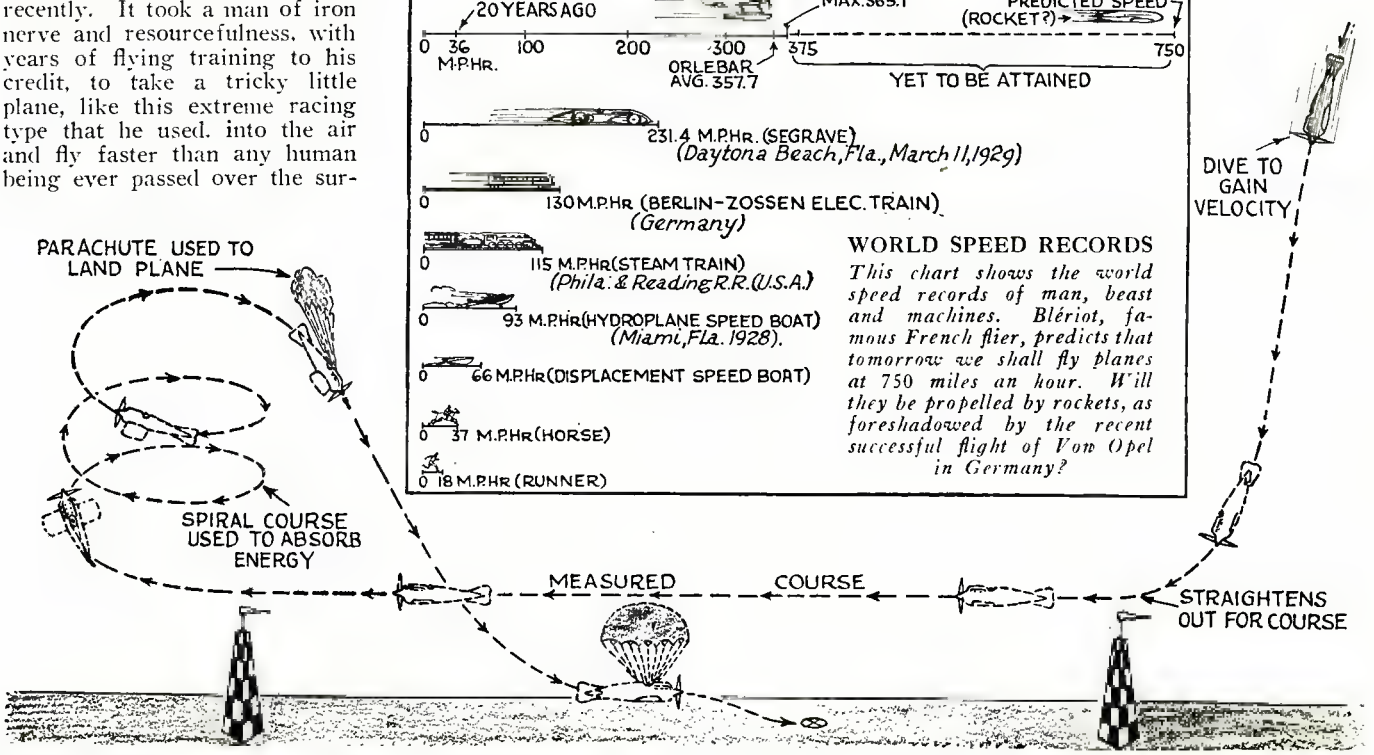


The fastest airplane in the world, the supermarine Rolls-Royce S-6, is here shown in flight.

SIX miles a minute—365 miles an hour—was the terrific pace set by Augustus Orlebar, British squadron leader, who took part in the flights for the famous Schneider trophy, off the coast of England recently. It took a man of iron nerve and resourcefulness, with years of flying training to his credit, to take a tricky little plane, like this extreme racing type that he used, into the air and fly faster than any human being ever passed over the surface of the earth before. Orlebar is the world's speed king today. Next, we should salute the engineers who designed the plane made famous by Orlebar, the supermarine Rolls-Royce S-6. Orlebar established the world's supreme record for speed in a man-carrying vehicle on September 12th, when he made four flights over the 1.8-mile course at Calshot, England, his average speed being 357.7, this value being found by taking the average value of two flights with the wind and two flights against the wind. As will be seen from the picture of Orlebar's famous speed record holder, the plane is fitted with large pontoons, and it took off from the water and also landed on the water. Such planes as this have a landing speed in the neighborhood of 100 miles an hour, and it takes a super pilot to handle a plane at such speeds. In the diagram at the bottom of this page you will get a glimpse into what the future may hold for us, if we ever attain the 750 miles per hour speed, predicted by Louis Blériot, the first man to fly across the English Channel. Perhaps the racing planes of a few years hence will be propelled by rockets—who can say?

WORLD SPEED RECORDS

This chart shows the world speed records of man, beast and machines. Blériot, famous French flier, predicts that tomorrow we shall fly planes at 750 miles an hour. Will they be propelled by rockets, as foreshadowed by the recent successful flight of Von Opel in Germany?


PARACHUTE USED TO LAND PLANE
SPIRAL COURSE USED TO ABSORB ENERGY
DIVE TO GAIN VELOCITY
MEASURED COURSE
STRAIGHTENS OUT FOR COURSE

Blériot's formula for the 750-mile-an-hour plane of tomorrow: Shot from a catapult, the practically wingless plane flies across the course and, by ascending in a spiral, the tremendous momentum is reduced, the plane and pilot landing with a huge parachute.

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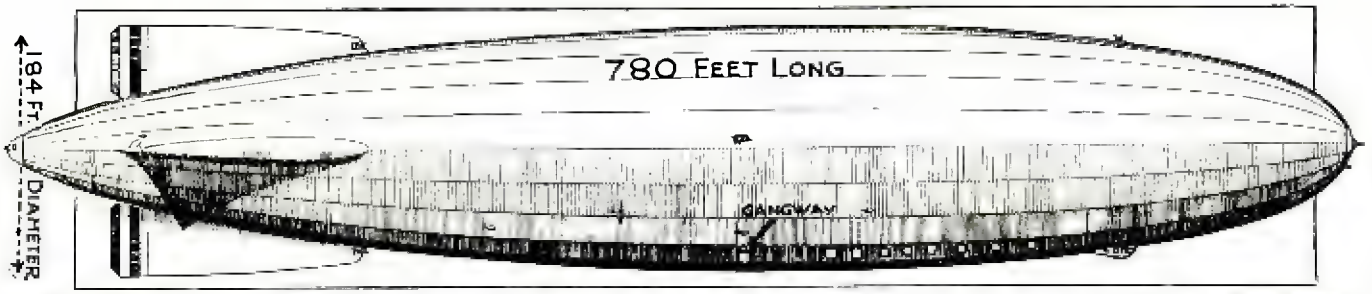
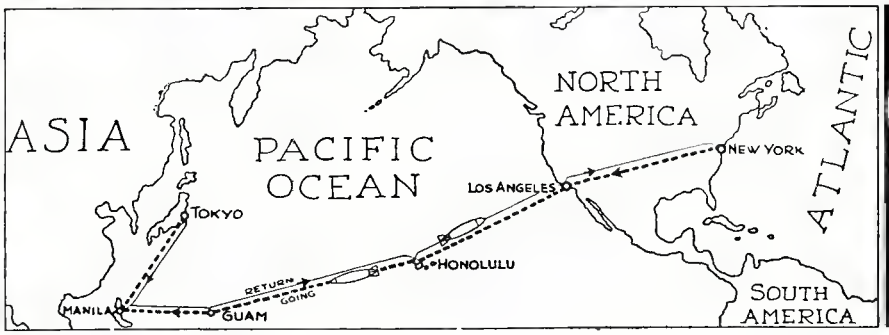


Paul W. Litchfield, president of the Goodyear Tire and Rubber Co., interested in Zeppelin trans-Pacific project.



Commander Hunsaker, vice-president of the Goodyear-Zeppelin Corp., active in the proposed Zeppelin developments.

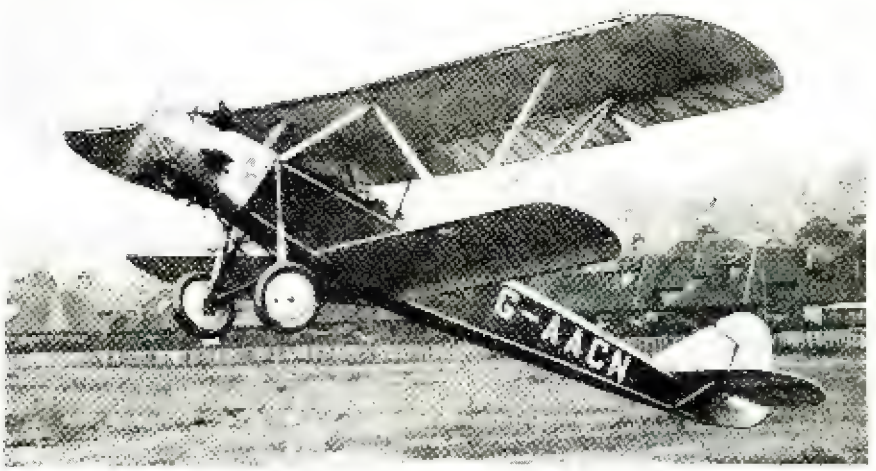
New York-Manilla by Air

Plan Projected by Steamship and Zeppelin Company

AT the top of this page is a sketch of the proposed dirigible, 780 feet long and 184 feet in diameter, designed to carry eight motors and 100 passengers, which is planned by the Goodyear-Zeppelin Company to be built for the Dollar Steamship Company, to be used in service from New York to the Orient. If the negotiations result in a satisfactory agreement between these two companies, the first service would probably be between San Francisco and Hawaii. Passengers, mail and light freight would be carried. The dirigible would be four times faster than a ship.

CAN'T FOOL THIS PLANE!

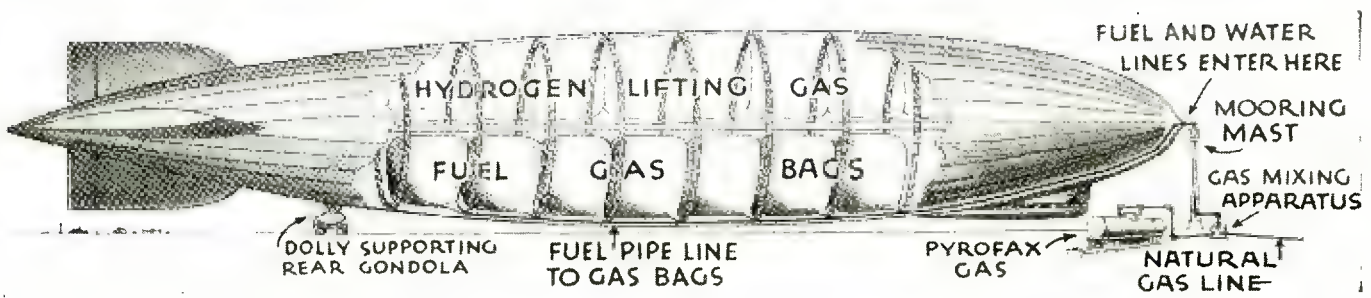
Wing Slots and Flaps Permit of Safety in Unusual Take-Offs



The powers of automatic interconnected wing slots and flaps are shown in this remarkable photograph. The machine here illustrated is the Handley-Page taking off in a perfectly normal manner but at a very acute angle. This machine is to compete for the Daniel Guggenheim Aircraft Safety prize. Tail spins are said to be impossible.

Fuel Gas Piped to Zeppelin Through Mast

THIS diagram shows how natural gas taken from a well was mixed with pyrofax gas to supply the fuel gas bags of the *Graf Zeppelin*. The mixed gases were led through a pipe in the mooring mast at Los Angeles and from there fed to the fuel gas bags of the giant air liner. These fuel gas bags also serve to aid in the lift of the air liner. Water is piped to the air vessel in the same way. The use of gas fuel operates to secure an approximately constant weight.



How natural gas and pyrofax gas is mixed and piped through mast to dirigible.

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Recent Inventions *Based on* Modern Chemistry

By Henry Townsend

Pocket Alcohol Tester

WITH this pocket testing outfit any liquid can be tested for the presence of wood alcohol and the percentage noted. An alcoholometer shows the percentage of wood alcohol present and "proof" may be obtained by multiplying the reading by two. When testing the liquid for the presence of wood alcohol, a pale pink color will be produced by a faint trace of this poisonous substance, and with increasing amounts the color deepens to a red-violet. Absolute absence of color after fifteen minutes proves that a liquid is free from wood alcohol.

Lindbergh's Aeroplane Ice-box

AN aeroplane ice-box which was built for Colonel Charles Lindbergh is being demonstrated by the young lady. Dry ice, frozen carbon dioxide, is used for refrigeration. The refrigerator is made of balsa wood and weighs only 2 lbs. Ice-boxes of this type will soon be installed on passenger-carrying aircraft.

Balsa wood is of extreme lightness, yet it is a true wood of an exogenous tree. It has been used to construct boxes or retainers for ice-cream.

Lumber from Farm Wastes

Testing lumber fabricated from farm wastes.

MR. A. HAWERLANDER, a German chemist, with his associates, recently demonstrated a process by which farm waste, such as cornstalks, sugar cane, and shavings can be converted into lumber. The fabricated material possesses the characteristics of true wood and can be sawed, planed or nailed. 10,000,000 tons of cornstalks would make 9.000.000.000 sq. ft. of lumber.

Dry Ice Machine

DRY ice is made in the laboratory with the machine shown at the right. Carbon dioxide, which is a gas in its normal state, is solidified with this apparatus, thereby greatly reducing its temperature. Dry ice is so cold that it cannot be held in the hand without producing a severe burning feeling. It is called dry ice because it does not melt into a liquid but into a gas.

This new substance has many uses in the laboratory, as the actual temperature that can be obtained is much lower than that of ordinary ice. A machine of the type shown would therefore be useful in the laboratory, as it makes it no longer necessary to have complicated apparatus to experiment with the lower temperatures.

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When the Fates Fooled HARRY KELLAR

Master Magician

How man who mystified thousands was fooled by a "ghost" that didn't materialize.

By Dunninger

THE theatre was filling rapidly. Beautiful women attired in evening gowns escorted by faultlessly groomed men were consulting programmes. Neatly uniformed usherettes were leading late comers to their seats. The air was filled with rare perfumes emanating from silken-clad members of the fair sex, all alive to the possibilities of a new thrill. Groups were discussing the master of magic, Harry Kellar, whose yearly visit to that city always brought out theatre-goers who never were disappointed by the type of show this wizard presented.

The orchestra was tuning up. Talk ceased. All eyes from orchestra seats to top balcony were centered on the stage.

The overture was being played . . . a medley of weird oriental airs. . . .

With a crash the music stopped. The footlights threw fantastic shadows onto the main curtain, which hid the *mysteries of the past and present* from the world before the curtain.

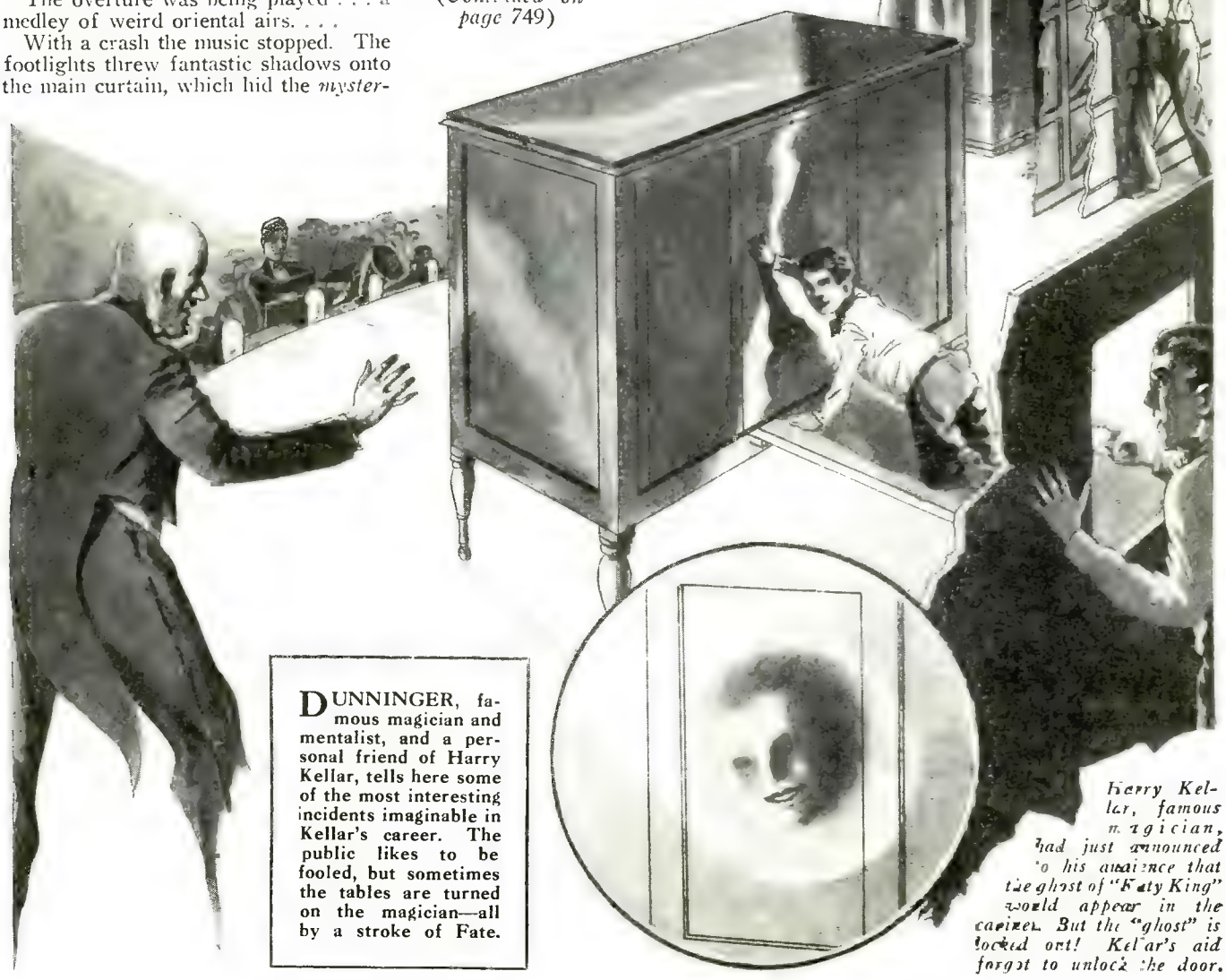
Slowly, majestically, the front curtain draped upward . . . the house was still . . . out onto the stage walked the Great and only Harry Kellar, the dean of magic, mystifier par-excellence.

A tremendous volume of applause greeted him.

Kellar gracefully bowed his silent thanks to their appreciative outburst . . . to him this was no new thing. In this manner he was greeted upon his entrance throughout the world, wherever he had appeared.

Enthralled, they sat watching every trick, deep in the mystification of this master's artistic efforts.

(*Continued on page 749*)



DUNNINGER, famous magician and mentalist, and a personal friend of Harry Kellar, tells here some of the most interesting incidents imaginable in Kellar's career. The public likes to be fooled, but sometimes the tables are turned on the magician—all by a stroke of Fate.

Harry Kellar, famous magician, had just announced to his audience that the ghost of "Katy King" would appear in the cabinet. But the "ghost" is locked out! Kellar's aid forgot to unlock the door.

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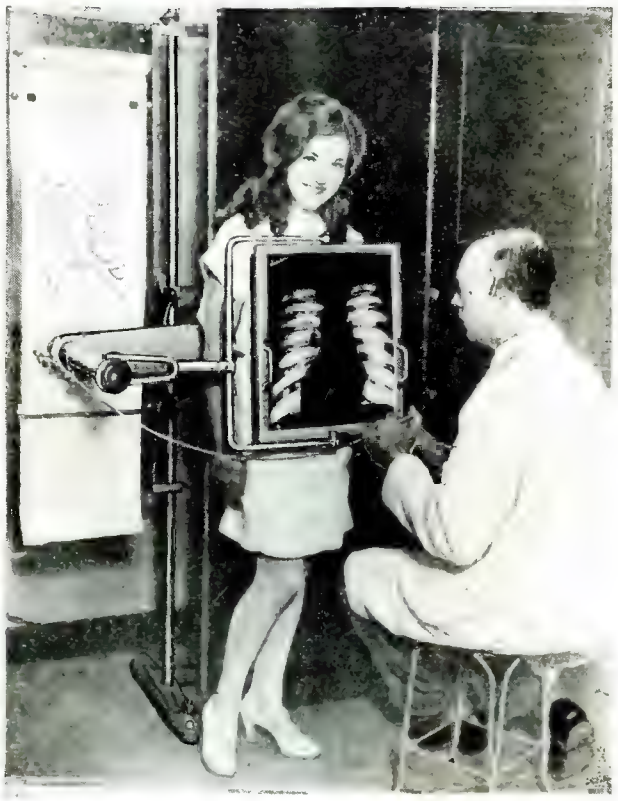
In the Scientific

Unusual Developments in



This Machine Maps Your Ribs

IN the examinations of patients by means of X-ray, the physician often wants to record things that he sees and yet, for some reason or other, does not care to take X-ray photographs of the patient. A mechanism has been devised whereby the physician can, by merely tracing a pointer along the screen, reproduce on a chart against the wall every movement which the pointer makes. The chart can be filed for future reference or unusual features can be directly marked on it for further study.

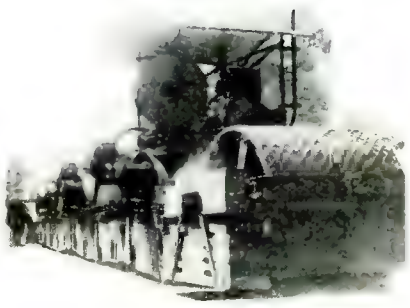
Air- and Water-Tight Life Suit

THE first demonstration of a life suit designed for shipwrecked victims was recently given in Germany. The paddles propel the victim. The lock at the waist separates the two parts of the suit and makes it air- and water-tight. The window on the helmet is open for calm weather. A valve allows for breathing when this is closed.

Controls Auto from Running Board

AN enterprising milk distributing organization produced an automobile which could be controlled from the running board. This saves the driver many steps and quite a considerable length of time, particularly when the run between deliveries is short as in neighboring houses. The auto is steered by a lever, and clutch and brake are located on either running board.

Taking Skids Out of Streets

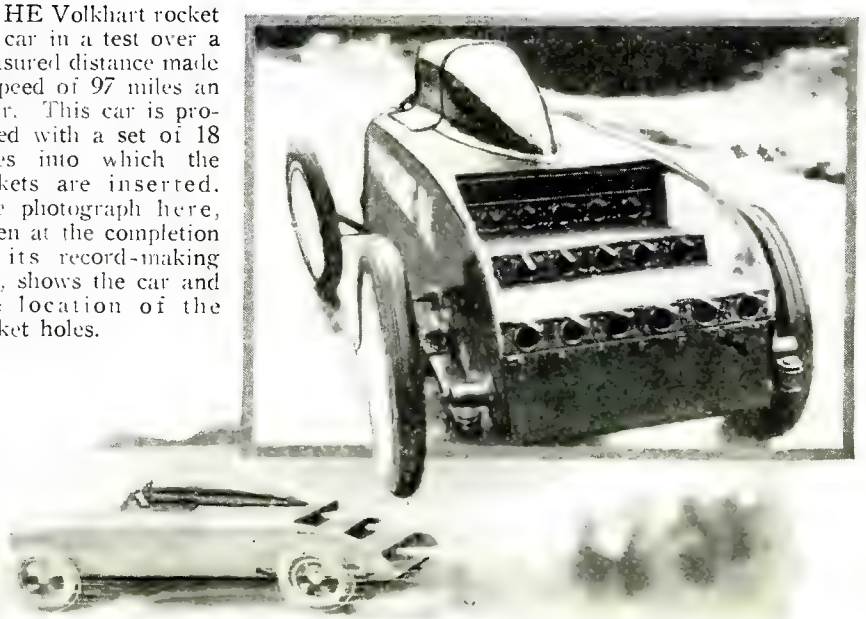


INSTEAD of blaming all skidding on the automobile, Berlin, Germany, prevents much of the skidding by running along asphalt streets with the machine here shown. This heats the asphalt and then the roller engraves a pattern in the street, producing a skid-proof surface.

The increasing use of concrete surfacing of streets reduces the scope of work of this machine.

Ninety-seven Miles Per Hour in Rocket Car

THE Volkhart rocket car in a test over a measured distance made a speed of 97 miles an hour. This car is provided with a set of 18 holes into which the rockets are inserted. The photograph here, taken at the completion of its record-making run, shows the car and the location of the rocket holes.



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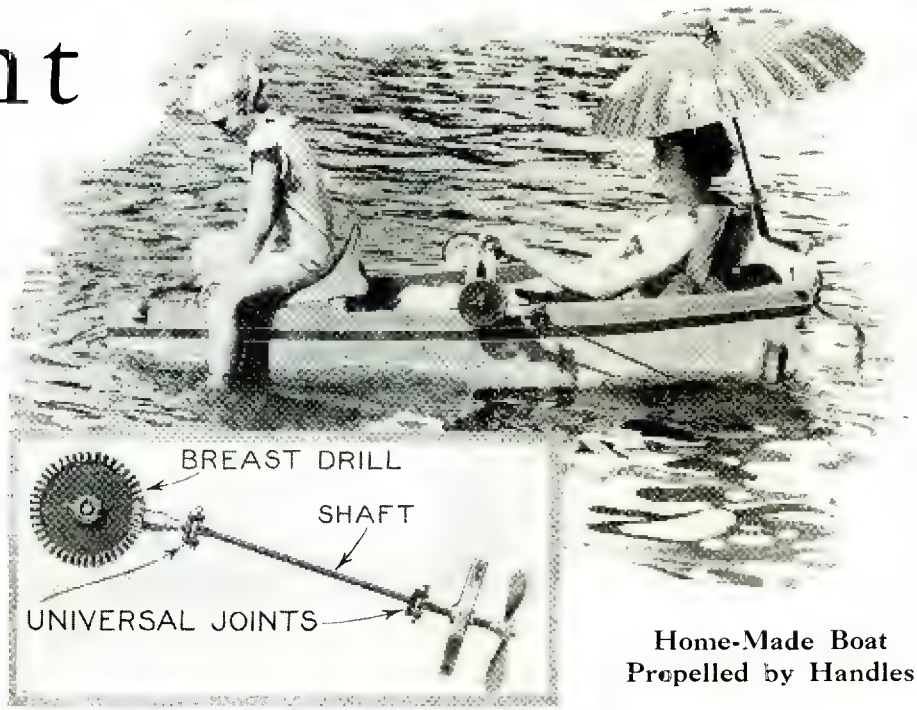
Spotlight

Different Parts of the World

World's Longest Kite

IN China kite flying is far more popular than in this country. Many attempts are made to produce kites of fantastic designs or exceptionally large kites or establishing some sort of record for such fliers. The kites are usually made of bamboo and Oriental silk and are grotesquely decorated. One of the largest kites that was ever built was recently sent up at the Exposition Park in Los Angeles. This kite was built by Lee Shaw and is in the form of a dragon 240 feet long. It is powerful enough to lift a man off his feet.

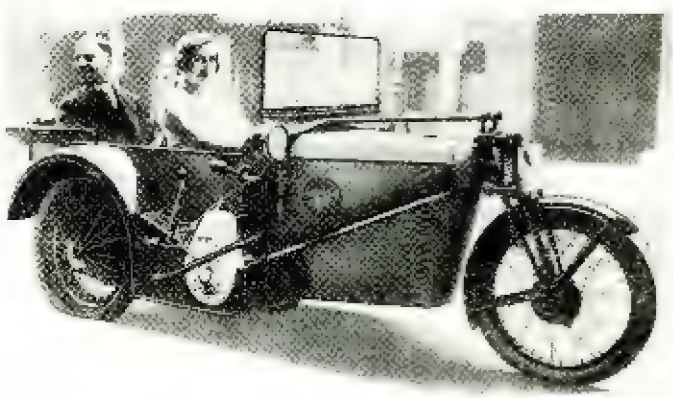


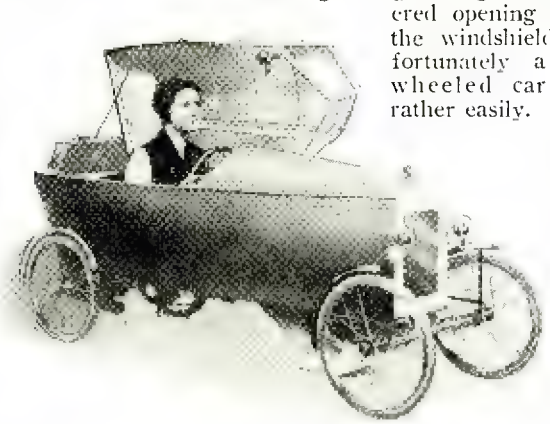
Home-Made Boat Propelled by Handles

THE novel boat shown in the photograph here was demonstrated on a lake called the Aldershot Lido, because it is ideal for both boating and bathing. This lake is in England. For the benefit of those readers who might like to duplicate the novelty, an illustration showing how two old breast drills can be pressed into service is found immediately under the photo. This boat requires no rudder, one propeller being speeded up slightly for the turn. Propellers and shafts are on either side of the boat as the photo shows.

This Auto Has Three Wheels Only!

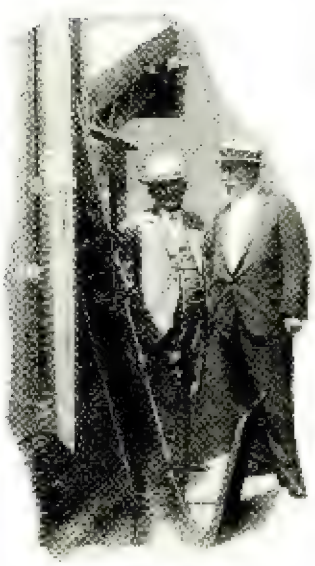
CERTAIN laws in Germany make a three-wheel automobile very much to be desired, because no automobile license is required, and such a machine is exempt from the state automobile tax. Here is one that was recently put out by the Manos Auto Works in Germany. It will attain a speed of 25 miles an hour. Note the motor on the outside of the car and the rod for steering rising through a flap-covered opening beneath the windshield. Unfortunately a three-wheeled car upsets rather easily.





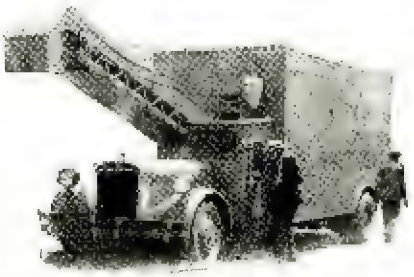
Dustless Removal of Ashes

THE new pneumatic conveyor shown in the photograph here sucks the ashes directly from the cellar and deposits them in a special car. This car then delivers the ashes to the dumping grounds. The conveyor was recently given a test in New York City before members of the Street Cleaning Department and the Fire Department. It aims to do away with unsightly ash-cans and eliminates dust.



French Automobile for $100.00

IN Paris, France, a car was recently exhibited that was hardly larger than a toy. This attracted a great deal of attention in the Paris Automobile Show. The automobile is powered with a 2½ horsepower motor. The wheels and tires are but little different from those found on a motorcycle. Their construction is lighter. To get into the car, one lifts the top, as shown, and steps inside. This auto can be purchased at a price of $100.00 in France and will attain a speed of 20 miles per hour.



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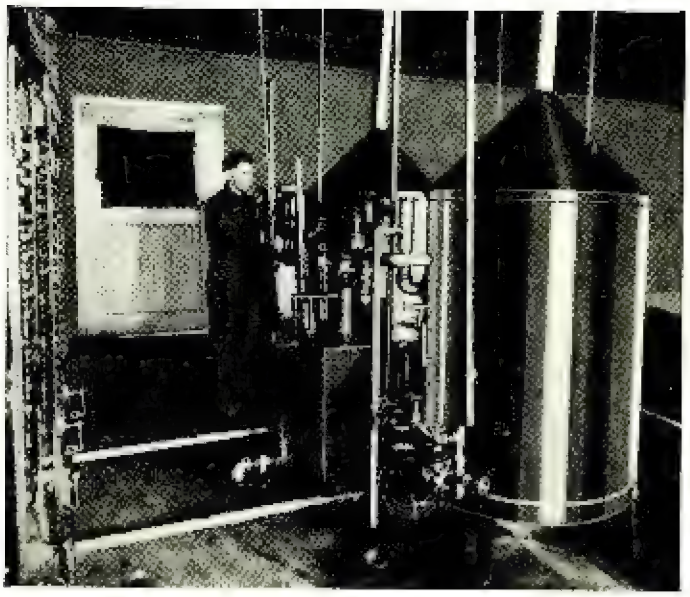


The photograph at the left shows the oil-cleaning apparatus in the oil supply house at one of the government aviation fields.

Super-Refined Oil

Many Gallons of Lubricant Can Now Be Saved by Cleansing Old Oil

By Alfred M. Caddell

THE motoring world—and that includes practically everyone in the forty-eight states of the U. S. A. and a good share of the population of other countries—is gradually learning a lot about the stuff that permits motors to spin and wheels to go 'round. During these last few years lubrication engineers have been engaged in a splendid educational work, which has meant considerable money in the pocketbook and a great deal of motoring satisfaction to every motorist. And now with aviation and motor-boating stepping along pretty fast, he is a wise man who takes sufficient time to learn a few pointers about the stuff that can either crash him from the clouds, tie him up on a roadway, or, on the other hand, permit his motor to purr a pleasant "Home, Sweet Home."

Not much of a popular nature has been written about oil. Most people simply regard it as slippery stuff and faithfully follow the recommendations of various oil companies to have their crankcases drained every 500 miles or so and refilled with new oil. If they are a little more careful than usual, they will request the grade of oil that the car manufacturer has specified, but, beyond that and beyond the distant landscape, lie the unknowing fields of innocent bliss. To most of them, oil is oil; to most garage men, oil is oil! But, to the dumb though sensitive motor, oil may be any one of a hundred things.

Compared to astronomy, chemistry, metallurgy and several other sciences that were handed down through the ages, the science involving petroleum is virtually an infant. Although petroleum had been observed seeping out of the ground for ages, even as recently as George Washington's time, it was regarded as something that merely spoiled good drinking water. In Pennsylvania the Indians collected small quantities of it and it was sold under the name of Seneca Oil for medicinal purposes. Then in 1859 Col. E. L. Drake drilled a well near Titusville, Pa., and following a blaze of excitement that developed, when the possibilities of oil struck the popular imagination, an era of industrial prosperity set in and is continuing up to the present days. For, contrary, to popular impression, the age of machinery did not develop the age of oil. Quite the reverse—lubricating oil made possible the development of machinery. Remove it from any machine or motor even for a few minutes' time and said machine or motor would speedily burn out its bearings or cease to move.

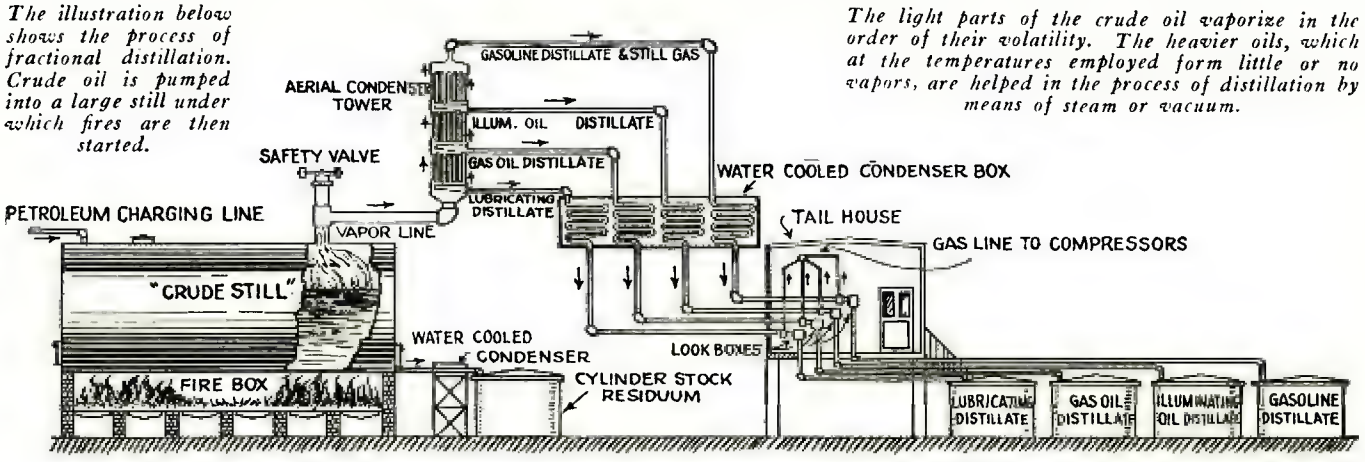
Crude petroleum is a highly complex mixture of compounds of hydrogen and carbon, running about 10 to 15 per cent. hydrogen and 80 to 85 per cent. carbon, the balance consisting principally of compounds of sulphur, oxygen, nitrogen and metallic salts.

Hundreds of different compositions, ranging between the extreme limits of gasoline on the light end and coke on the heavy, are separated from crude oil by distillation, after which these products are divided into many different grades, according to their physical and chemical characteristics and varying with the purpose for which they are to be used. Oil technicians, who necessarily must also be mechanical technicians, have spent their lifetime fitting lubricants to machines, in order that they may deliver a maximum of work. As a result, during recent years a vast oil technology has sprung up, the coming of the automobile contributing not a little intricacy to the problems of lubrication engineers.

How lubricating oils and fuels (gasoline, kerosene, etc.) are produced is of course beyond the scope of this article. Suffice it to say that the various groups and sub-groups are obtained through processes of fractional distillation. The crude oil is first pumped into the boiler of a large still, under which fires are started. Naturally, the light parts of the crude, like gasoline and kerosene, (*Continued on page 745*)

The illustration below shows the process of fractional distillation. Crude oil is pumped into a large still under which fires are then started.

The light parts of the crude oil vaporize in the order of their volatility. The heavier oils, which at the temperatures employed form little or no vapors, are helped in the process of distillation by means of steam or vacuum.



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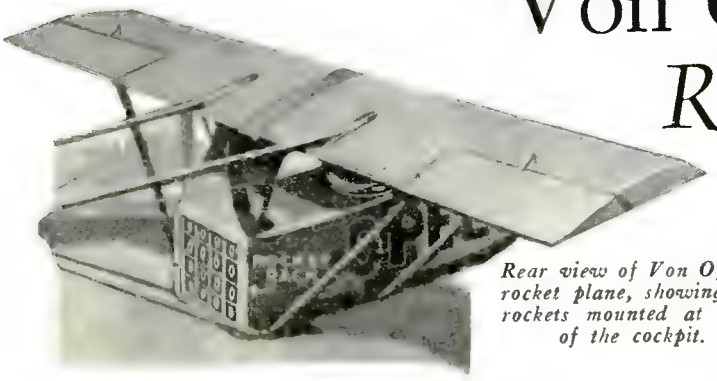
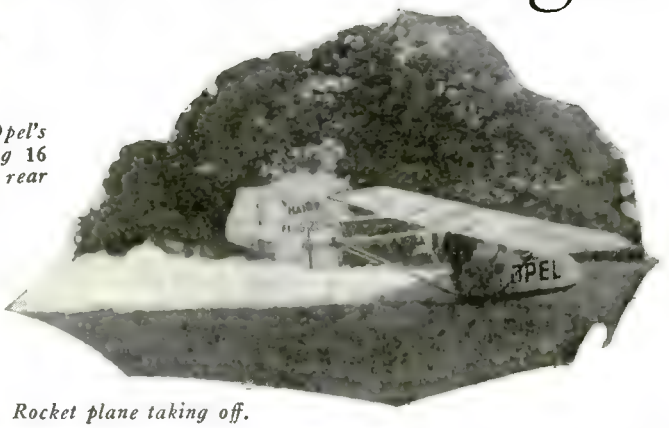
Von Opel Makes First *Rocket Plane* Flight

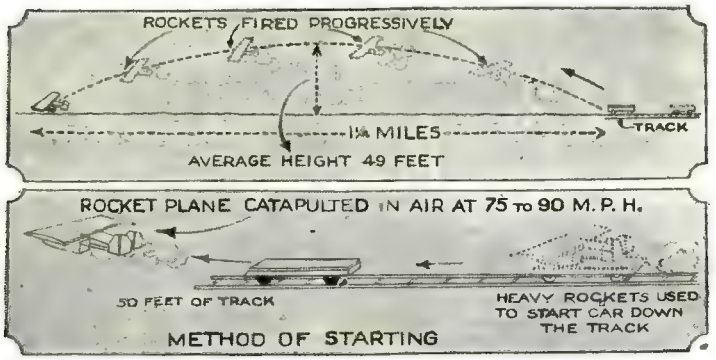


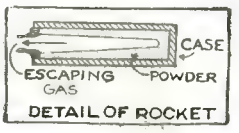
Rear view of Von Opel's rocket plane, showing 16 rockets mounted at rear of the cockpit.



Rocket plane taking off.

FRITZ VON OPEL made the first successful rocket plane flight on September 30th at Frankfort, Germany. Von Opel was in the air for one thrilling minute and a quarter and covered a distance of a mile and one-quarter, at an average altitude of 49 feet. The drawing below shows how the rocket plane was catapulted into the air at a speed of approximately 90 miles per hour. The rocket plane, which was really a combination of glider and engineless baby plane, weighed about 500 pounds with the pilot and the rockets on board. It rested on a wheeled carriage, which was hurled along a 50-foot length of track at tremendous speed by three powerful rockets weighing 10 pounds each and possessing a propulsion pressure equal to twice the weight of the loaded plane. The plane was catapulted into the air by the explosion of rockets fired by the pilot. The detail of one of the rockets is illustrated herewith, and they are ignited electrically one after the other by the pilot at his discretion.


ROCKETS FIRED PROGRESSIVELY
1¼ MILES
TRACK
AVERAGE HEIGHT 49 FEET
ROCKET PLANE CATAPULTED IN AIR AT 75 TO 90 M. P. H.
50 FEET OF TRACK
HEAVY ROCKETS USED TO START CAR DOWN THE TRACK
METHOD OF STARTING



A CIRCULAR AIR STATION *for* Kansas City

A VERY beautiful airport and a huge terminal station to house the largest airplanes has been designed for Kansas City, Mo., and is illustrated herewith. The circular terminal building will measure 450 feet in diameter on the ground floor, and the building will cover an area of 159,000 square feet. Around the building will be a concrete taxi path 100 feet in width, so that planes landing on the field can taxi in and be housed in any part of the structure.

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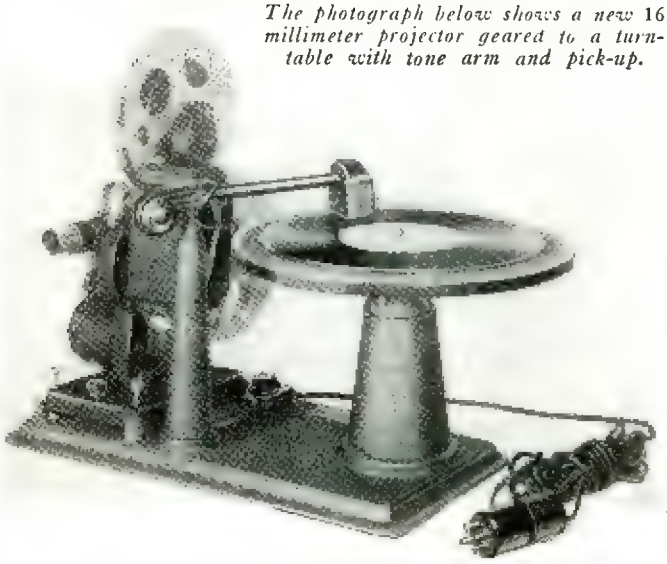
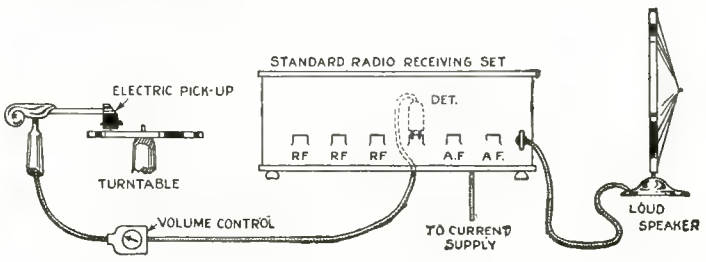
Amateur Talkie Equipment

The photograph below shows a new 16 millimeter projector geared to a turntable with tone arm and pick-up.



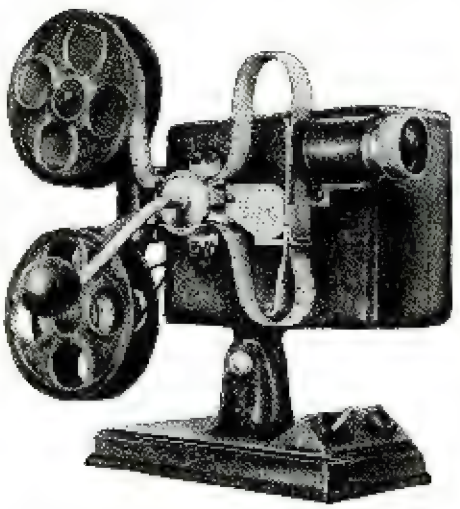
AMATEUR movie makers will be interested in a new home talking movie outfit which consists of a regular 16 mm. projector which is geared to a turn-table equipped with an electric pick-up. The latter connects to the audio amplifier in the radio set (a separate amplifier may be used) and a gear shafting synchronizes the action on the screen and the sound on the record. The drawing below shows how the record programs are reproduced through the radio receiver. Films or records can be run separately if desired. The operation is simple; it is simply necessary to thread the film through the projector, put the phonograph record on the disc, plug into the radio set and press a button.



New 16 mm. Projector for Home Movies

A NEW 16 mm. projector for home use was recently announced. This projector, while extremely low in cost, has many admirable features. It is made of die-cast aluminum, and is therefore very light in weight. While it is hand-driven, a motor can be added so that the machine can be entirely electrically operated. The motor possesses a unique feature, that of being controlled by an adjustable governor instead of a rheostat.

The optical system is very efficient and a specially designed bulb of the coiled type rated at fifty watts is used. At a distance of about twenty feet this gives a clear brilliant picture, about two and one-half by three feet. A quick threading gate and claw type intermittent movement, together with a single feed and take-up socket comprise the mechanism for shifting the film with regularity.



The magazine arms have a capacity of one hundred feet, although auxiliary arms can be obtained of four hundred feet capacity.

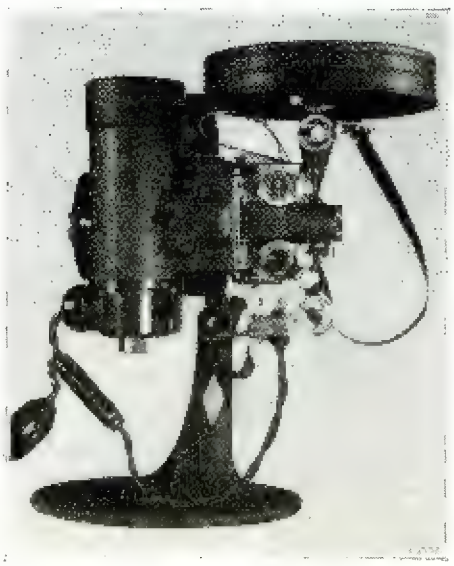
For use in rural districts where there is no electricity, a special lamp that consumes only six volts may be used, operated from a storage battery or from four dry cells.

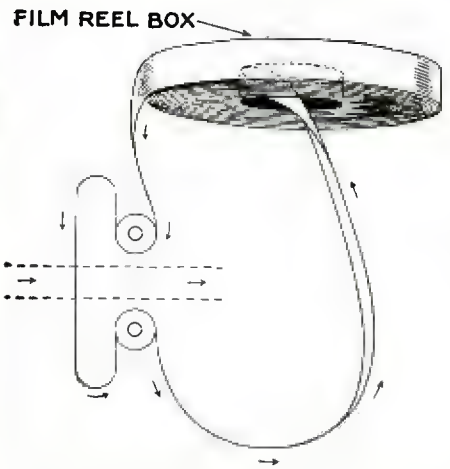
The machine comes complete in a carrying case that contains space for the extra film.

The manufacturer expects to soon announce a low-priced sixteen millimeter camera in combination with this projector, thus opening the home movie hobby to many heretofore unable to enter it because of the high cost of equipment. The photograph shows a view of this low-priced projector.

Continuous 16 mm. Movies for Advertising

ONE of the larger amateur movie equipment manufacturers is now making a continuous projector attachment for use with their regular projectors, by means of which the same film is shown over and over again. The attachment consists of two major units which are slipped upon the projector. A drum at the top contains a continuous reel upon which the film is wound, and in place of the lower reel arm, a mercury switch is provided which automatically shuts off the current should the film break. The ends of the film are, of course, spliced together. In the drum the film rests on its edge and is kept moist by a humidifying device which is an important factor, especially when projection is continuous. All rollers over which the film passes are designed so that contact is made on the film edges and margins only. The film is never scratched.





The continuous projector is shown in the photograph at the left. A drum at the top replaces the other reel arm, and houses the continuous reel containing the film, as shown in the above drawing.

Names and addresses of manufacturers on request.

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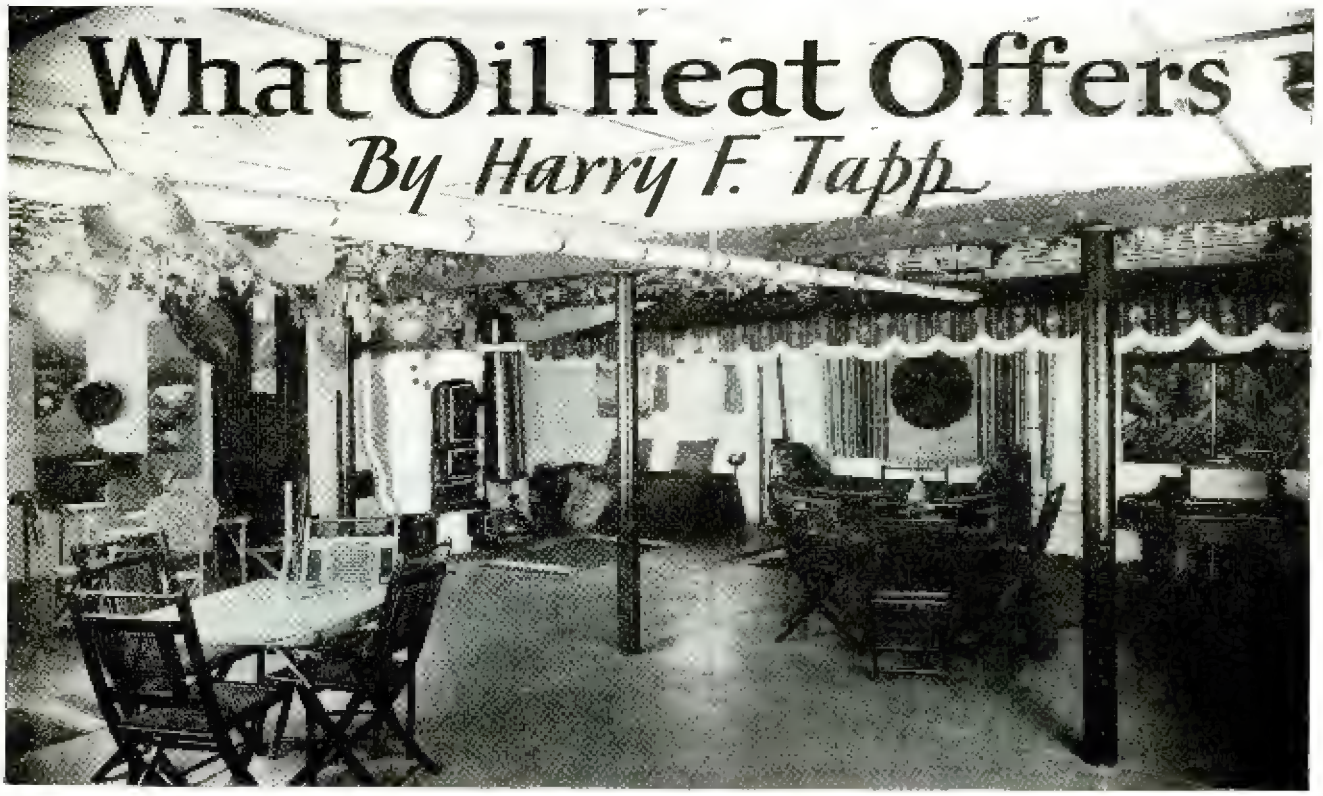
What Oil Heat Offers

By Harry F. Tapp



Your basement may be used like this, when an oil burner is fitted to the boiler, seen in far corner.

THE user of oil-heating equipment adds to his life real liberty. He has been released from the traditional furnace chores and in the changing of a dull cellar filled with coal bins, ash cans and coal scuttles to a pleasant room, or rooms, free from dust and grime, there are infinite possibilities for the pursuit of happiness for all members of the household.

Once the basement has emerged from its primitive state you may decide to what use to put the space. If it is to be used as a children's play room—let them help work out the plan themselves. Most children like to draw or paint, and they should take great interest in drawing a frieze of animals walking to the ark, across a beaver-board wall space.

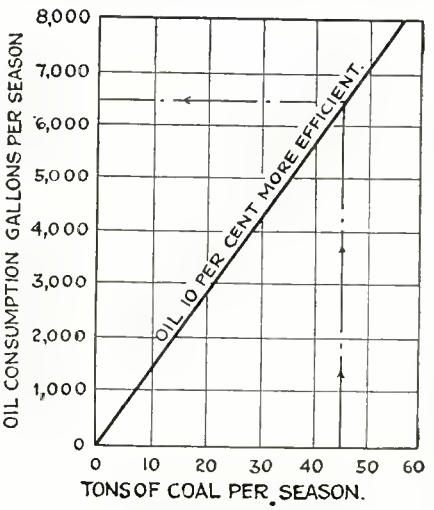
Older children would find it an ideal place to put the articles from their manual training classes, room for a permanent platform for the electric trains, always underfoot upstairs, or an unequalled opportunity for a real play house. An important point is that all well designed burners have all moving parts and adjustable features inclosed so that children playing in the vicinity are not able to tamper with the mechanism.

If the children's play room, assuming that your family includes the youngest generation, is incorporated in your upstairs floor plans, then why not fit up part of your basement as a gymnasium, with possibly a standing shower bath in one corner? This, too, would be the logical place for the scales and any heavy gym equipment which cannot always be installed with safety upstairs.

For a man who does his work at home a basement studio or workshop makes a secluded retreat from wailing infants, ringing doorbells, vacuum cleaners and other domestic activities.

HARRY F. TAPP, the engineer who prepared this series of articles on oil burners for residence heating, is one of the foremost experts on this subject. Mr. Tapp is the author of the "Handbook of Domestic Oil Heating." This is the second of a series of articles.

A division of space is, of course, possible, although if rooms are walled off the heating will usually have to be taken care of by extra radiation. A sewing room would be appreciated by the woman who makes her own clothes, with room for a cutting table, sewing machine and dress dummy. So much more work can be accomplished when one does not have to put everything away at meal time or at night, but can go back to work and find things as they were dropped.



To compute cost of oil fuel per season, ascertain cost per gallon from local dealer and multiply this by number of gallons equivalent to your present coal consumption. If you burn 20 tons of coal, glance upward till diagonal line is met; look along horizontal line to left and we find 2,900, or roughly 3,000 gallons of oil.

And what a place for parties! All you need is the dance floor and a victrola, or run an extension loud speaker from your radio. You can be very Greenwich Village on almost nothing, with candles in bottles and all that sort of thing. We've even heard of people installing a miniature bar in their cellar. Of course that is optional, but it does add atmosphere. The saving on wear and tear on the living-room furniture is no mean item, as any hostess will testify. The "morning-after" duty—picking cigarette stubs and ashes from between the cushions and gathering in the stray glasses that will be left in the most unlikely places—loses half of its terrors when you know that, no matter what was spilled, or if a cigarette missed the ash tray, no one need worry.

Many people utilize their new basement rooms as servant quarters or an emergency guest room. To quote one owner who found good use of this room: "If I hadn't been burning oil, it would have been necessary either to make an addition to the house or move into a larger place when my son and his wife came to live with us. The fact that the basement could be used made this expense unnecessary. I honestly believe, in estimating heating costs, a rental charge should be made against the coal bin."

Even if you don't go in for gymnastics or hilarious parties, if your children are grown up, (*Continued on page* 744)

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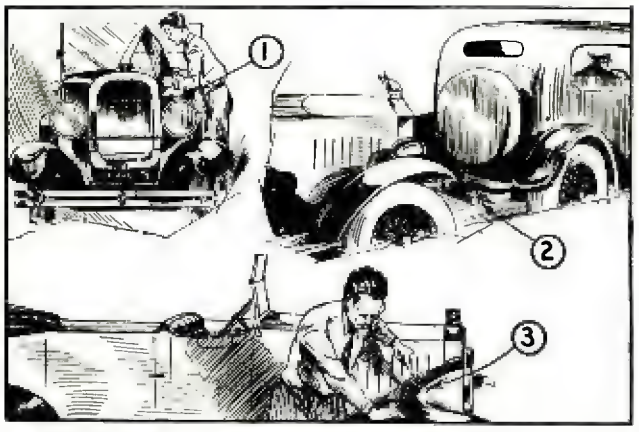
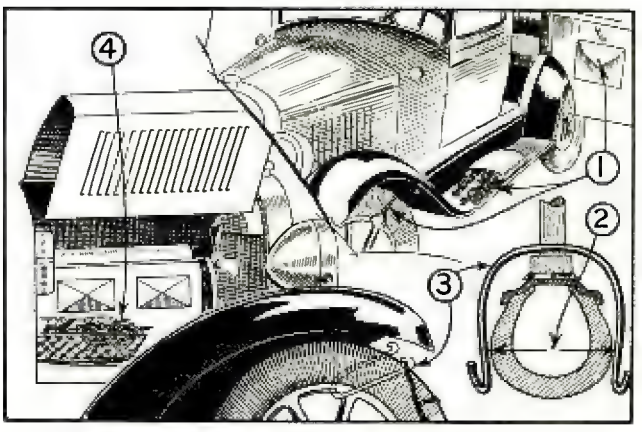
Motor Hints

For Car Owners and Drivers

Conducted by George A. Luers
Automotive Engineer



1—Hood scratching causes chromium break; 2—Bumper scraping helps ruin chromium; 3—Screw-driver nick does it too.



1—Door-pocket for snap-on chains; 2—Wire hook to fit snug; 3—Snap chain on, using hook; 4—Regular chains under hood.

Take Care of Your Chromium

FEW car owners are aware that chromium plating must be treated carefully. The layer of chromium is from .0002 to .0004 of an inch in thickness. Present methods do not permit of a heavier deposit. Where the plating is over brass, the film is easily worn through by abrasion. If over steel. the scratching of bumpers and engine hood edges will break off the chromium. Once broken, the rust and corrosion tends to cause peeling due to these scratches.

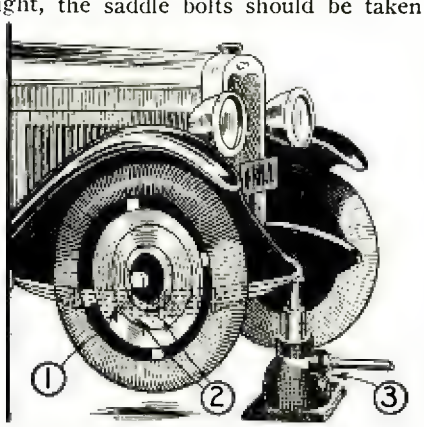
Another weakness of the thin plating is that the film, by reason of electrical deposition, is inclined toward being porous. If wet mud or dirt is allowed to remain on it, rusting of steel under it will occur.

Stop Springs Breaking

VIOLENT spring action, due to frozen roads, result in many broken springs.

A solution of beeswax in gasoline or of resin in turpentine is applied between the leaves of the spring.

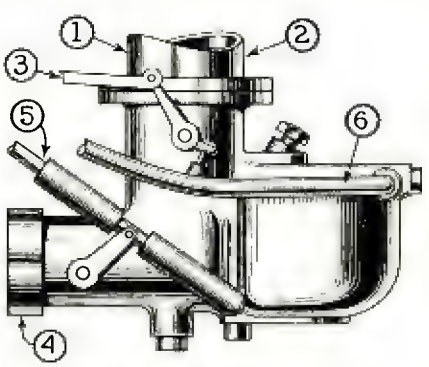
The spring clips should then be made tight, the saddle bolts should be taken up solid and the shackles should be adjusted so as to take outside play.



1—Solution is brushed on spring; 2—Then make clips tight; 3—Position of jack while treating springs.

More Mileage with New Carburetor

NEWS is gradually getting around that the carburetor used on the Model "A" Ford is an effective gas saver for old model cars in cases where it can be attached. Recently two owners, one an Essex and another a Studebaker owner, applied these in place of the old equipment. A gain of fifteen



1 and 2—Intake manifold of engine; 3—Accelerator connection to dash; 4—Hot-air pipe can be used; 5—Dash choke control rod.

per cent or more in gasoline mileage resulted.

Carburetor flanges are now made uniform, except for diameters of intake manifold. The carburetor mentioned has a one-inch opening for the intake manifold. If an elbow fitting is required, it is possible to obtain a suitable part from one of the dealers in carburetors.

How to Handle Tire Chains

THE best chains for short trips or to pull the car out of snow are the quick snap-on chains. which encircle the tire and rim. Three of these for each rear wheel will pull the car out of a tight place. Have a small waterproof container for these and they will stow in a side pocket, ready almost instantly.

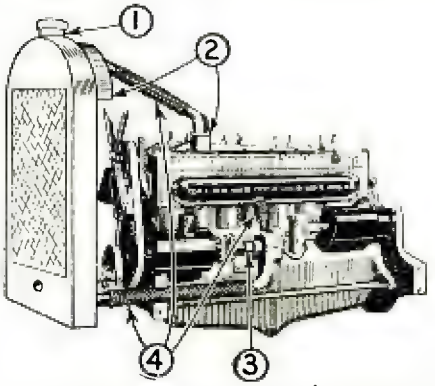
Regular duty tire chains are required for long trips through snow trails and in mountainous sections. A good way to place these on the wheels is to use a hook, made of quarter-inch wire, bent to the shape shown. Two of these are used so that both rear chains can be put on at one time. To put on the front chains, the car is driven backwards. Chains may be stowed in a wire basket under the engine hood.

Preparing the Radiator for Winter

THE radiator should be prepared in advance for the anti-freeze mixture. Not alone should the radiator be flushed, but all weak spots should be made tight.

The procedure outlined below shows the main items which should be attended to.

If one-half pint of kerosene is poured into the radiator water, prior to this work, it will do much to clear out scale, kerosene being used for this purpose in water and steam boilers where it has proved effective.



1—Clear out scale; 2—Force iron cement into crevices; 3—Repack pump gland; 4—Inspect hose, tighten clips.

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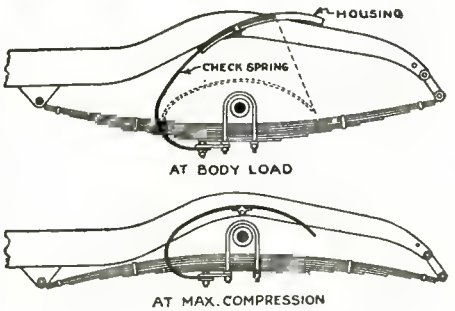
A Review of Some of the Latest Accessories Which Will Add to the Comfort and Pleasure of Motoring. A Two-Way Shock Absorber, an Oiler Which Effectively Lubricates the Combustion Chamber, and a Windshield Cigarette Lighter Are Shown

Bump Control *for the* Auto

Automobile Spring Control Insures Freedom from Jolts and Clatter

The above photograph shows the shock absorber installed on an automobile. The illustration at the right shows the check spring and main spring under static or body load and the position of the check spring under maximum compression of the main spring.



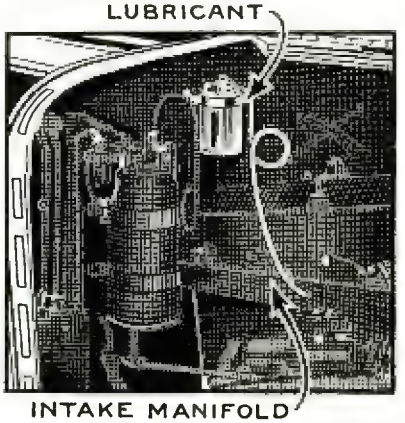
AN automobile spring control which eliminates to a great extent the shock felt when passing over bumps is shown in the illustration. It requires no lubrication and uses no fluid-filled chamber for checking the shock. The chassis springs can work both ways unresisted by friction within the desirable limits. It not only cushions part of the compression thrust but checks violent rebounds. The line drawing shows the bump-check spring which is inserted under the main spring. The compressed position of the spring is indicated by the dotted lines. When the main spring is compressed the check spring slides over a friction mat.

The spring control effectively resists the double throw of balloon tires and soft chassis springs and maintains a free center under any load. The device stabilizes steering by preventing side-sway and augments the natural straight-away characteristics of the steering system.

Cylinder Lubricator

THE life of the automobile engine can be lengthened and better performance obtained through the use of a combustion chamber lubricating appliance. The device introduces a special penetrating oil into the cylinder. It operates by vacuum to the intake manifold and thence to the cylinders, thoroughly lubricating the cylinder walls, the upper piston rings and valves. An oil container is provided which is bolted to the car in a suitable position. The oil flows from the container through a metal tube to the intake manifold. Where the manifold has already been tapped, the lubricator can be attached in a few minutes. The oiler eliminates carbon troubles to a great extent.

Easier motor starting and quicker pick-up are assured by the proper lubrication of the cylinders. The oil reservoir carries enough oil to last for approximately 500 miles.



The above drawing shows the lubricating device attached to the car with connection made to the intake manifold. The photograph at the left shows the oil container, connecting tube and can of special penetrating oil.

Windshield Cigarette Lighter

The above photograph shows the automobile cigarette lighter in operation. The cover is pulled off to light the device.

FOR the motorist who smokes, the new cigarette lighter shown in the photograph will prove to be a valuable accessory. A rubber suction cup on the base allows it to be fastened to the windshield or windows of the car. When a light is required it is simply necessary to pull the top or cover of the lighter from the base. The wick and fuel are placed in the removable top and alloy in the base. A special spring contact brushes across the pyrophor when the top is removed.

Money from Auto Inventions

THERE is hardly a better field today than that of automobile appliances on which inventors can expend some of their ingenuity. The devices described here will give some idea of what other inventors have produced. There are still a surprisingly large number of automobile specialties which someone should invent.

Names of manufacturers supplied upon request

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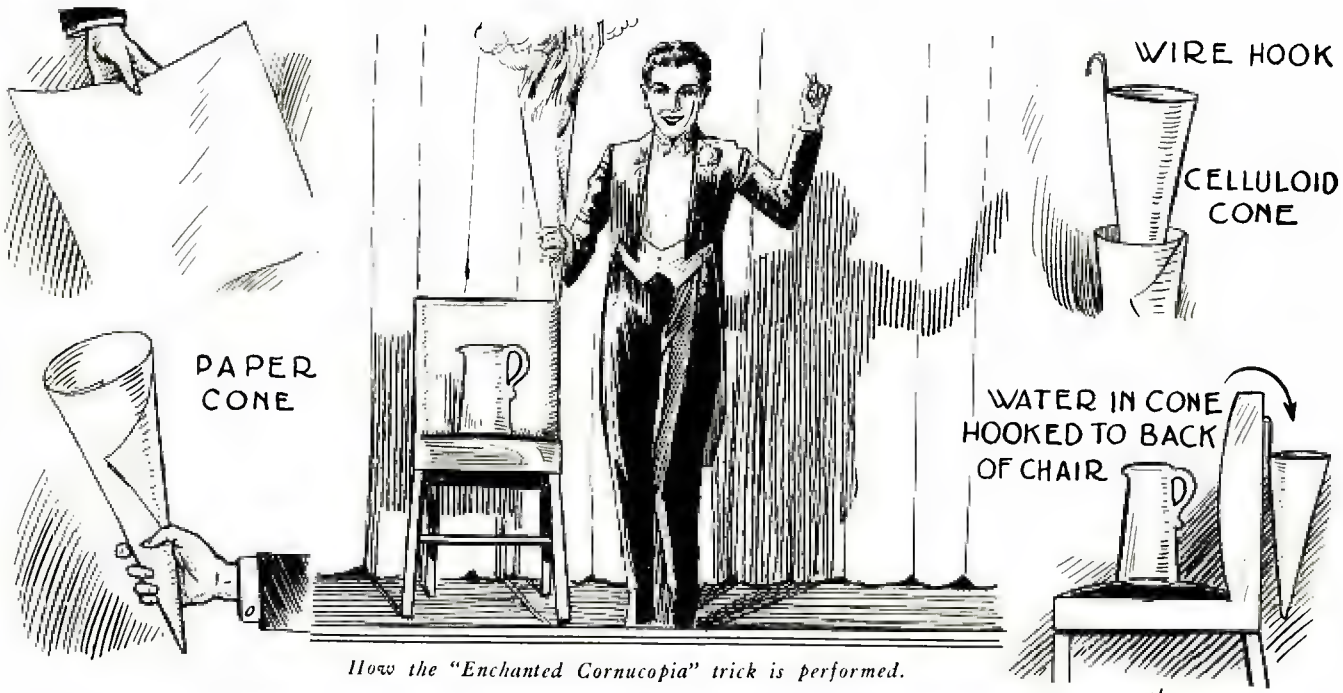
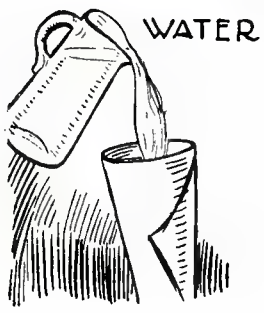
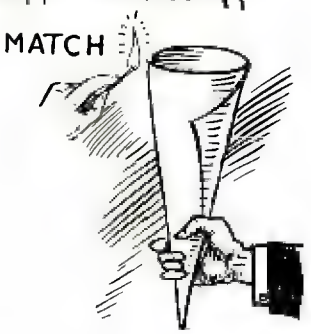


How the "Enchanted Cornucopia" trick is performed.



MAGIC

By Dunninger



No. 76 of a Series

Allah's Candle

THIS magical device can easily be constructed by the reader. Effect: The magician exhibits what seems to be an unprepared tallow candle. He lights this—then with some patter (talk) about an Indian high priest who could light candles by power of will, he blows upon the candle and extinguishes it. A few passes and the candle relights—another pass and it goes out again. Secret: A wick saturated with benzine and operated by the slide pulls the flame in and out of the metal candle.

The Enchanted Cornucopia

THIS effect trick is illustrated at the top of the page. The magician first makes a cornucopia of paper. He then fills this paper cone with water from a pitcher. Putting the pitcher aside on the seat of a chair, he asks his assistant to light a match and set fire to the cone. This slowly burns until entirely transformed into ashes, which drop to the floor. The water has vanished. Explanation: The cornucopia, which can be rolled out of flash paper to produce a more spectacular effect or out of newspaper, is rolled up and then, while reaching for the pitcher of water, is passed behind the chair to pick up a celluloid cone hanging there. The water is now ostensibly poured into the paper, but actually into the celluloid cone. Another pass and the cone containing the water remains suspended on the back of the chair after which the paper is burned. With a little practice and misdirection, this trick can be presented so as to leave the audience quite bewildered. This and the Allah's candle trick are good foils for each other.

Ultra-Coin Trick

ONE of the greatest difficulties in the manipulation of coins is to handle them with that dexterity only possible by experts at sleight of hand. The novice or student often prefers short-cut methods because they have not the time to devote to hours of practice. A thimble, soldered to the center of the coin will prove of great advantage. With the coin palmed, the wizard has but to close his fingers, insert the middle finger into the mouth of the thimble and open his hand. The coin will be carried to the finger-tips in an expert-like move.

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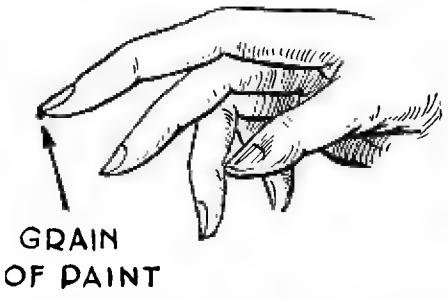
A mystic trick performed with a painter's palette containing assorted colors.

The Mystic Eye

THIS is a novel and effective thought-reading trick. A painter's palette, with a number of small squares of paints of assorted colors, is passed for inspection. A small nickel-plated box, slightly larger than the squares of paints, is likewise examined. As these articles are actually unprepared, rigid inspection is invited. During the wizard's absence from the room, one of the spectators is requested to place one of the paints into the box. Upon the magician's return, he is handed the box, which he holds behind his back in the one hand, while he raises his other hand to his head, to enact a picture of deep concentration. Shortly he calls the color of the paint concealed in the box.

Secret: In the act of holding the box behind his back, the wizard quickly opens it for a moment and secures a few grains of the paint beneath his finger-nail by scratching the nail across the surface of the square. In the act of raising his hand to his head, he thus has but to secretly observe the color beneath his nail.



Above: How the magician gets a sample of the paint as he holds the box behind his back.

Can You Answer These Science Questions?

THE following questions on general science can be answered, if you have carefully read the articles appearing on the pages mentioned. Practically no one today considers himself well read unless he possesses a fair knowledge of scientific subjects. Here are the questions:

1—What is the water pressure in pounds per square inch at a 2500 foot depth below the surface of the sea? How far can a diver ordinarily descend into the sea? (See page 684.)

2—Where are palaces and apartment houses and other buildings constructed of mud, and what would happen to them if a heavy rain descended? (See page 686.)

3—How many engines can safely go dead on a tri-motor airplane? How can a shotgun shell start an airplane engine? (See page 689.)

4—How is the latest automobile device arranged to prevent a car sliding backward down a hill, when the brakes will not hold it? How are the rear wheels driven in the newest gas-electric automobile? (See page 690.)

5—Does the new Baird televisor use an arc or incandescent lamp at the transmitter? How is the voice transmitted in this television system? (See page 691.)

6—How can a dirigible ascertain its height above the ground by measuring the echo of a sound wave? (See page 692.)

7—If you were sailing in a ship at sea in a fog and you wanted to determine if icebergs were in the vicinity, what simple scientific test would you apply? (See page 693.)

8—Can you explain in a simple manner how high voltage electricity is developed from water stored up in mountain reservoirs? (See page 694.)

9—What is the fastest airplane speed? What is the fastest railroad train speed? How fast can a horse run? (See page 698.)

10—If you had to lift many tons of ashes one hundred feet each day, in a simple mechanical manner, without using elevators or dumbwaiters, how would you do it? (See page 687.)

11—How is gasoline obtained from crude oil? What other important products are obtained by the same process simultaneously? (See page 704.)

12—How did Fritz Von Opel launch his rocket plane into the air, and what was its initial speed? (See page 705.)

13—Can you compute quickly the approximate relative cost of burning fuel oil to heat your home through the winter, when you know how many tons of coal you burn per season? (See page 707.)

14—What special precautions should be taken in order to preserve the new chromium-plating on your automobile trimmings? (See page 708.)

15—How would you go about developing and printing your own "home movie" films? (See page 712.)

16—Do you know how to make rayon? (See page 714.)

17—What is meant by a "growler" for electrical testing purposes, and how is it used? (See page 717.)

18—Do you know what simple formula can be used to "brown" gun barrels? Do you know how to drill holes through glass? (See page 721.)

19—Without using any relays or magnets and provided with a switch and a fan motor, how would you rig up a simple remote control "station selector" for your radio set? (See page 724.)

20—Describe the Diesel engine cycle. How is a lady's head made to appear as if floating on swords by means of mirrors? How is a hail stone formed? (See page 729.)

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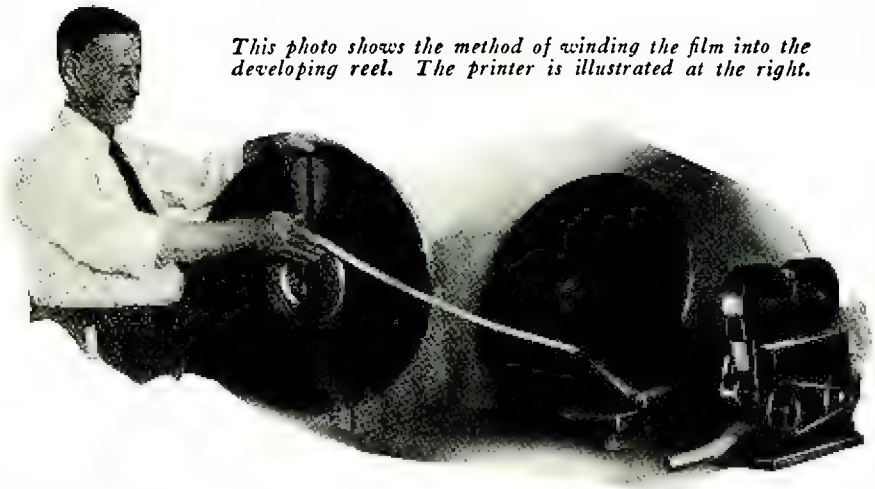

This photo shows the method of winding the film into the developing reel. The printer is illustrated at the right.

HOME MOVIES

How You Can Develop and Print Your Own Movies at Home

By Don Bennett

EVENTUALLY, every amateur movie maker feels the urge to try his hand at processing his own films. This is a laudable urge and one that deserves the utmost assistance from those in a position to help the amateur.

Professional laboratories are full of expensive equipment. Complex mechanisms are necessary for the processing of reversal film. And although the equipment needed for professional negative-positive work is not as elaborate or expensive, still it is beyond the reach of the average amateur. Our problem then is to find some means of placing in the hands of the user the most inexpensive equipment that we possibly can. The amateur must use small quantities of chemicals or the expense will be prohibitive (the commercial laboratories use forty gallons of developer in each tank). This requires the use of small tanks and smaller racks than the professional uses.

Photo by Herbert C. McKay

Fig. 3. This photo shows the Stineman 16 mm. printer in use. Note its small size.

Figures 5 and 6 show two racks that can be easily made by anyone handy with tools. The easier one of the two only holds ten feet of film because of the spacing that is required between the pins. If this spacing were not there, there would be a possibility of the adjacent layers of film touching each other and preventing development of the image. The rack shown in Fig. 6 is more difficult to build but is more satisfactory and holds more film. It is made of brass or copper ribbon 1/32 inch thick by ½ inch wide. The ribbon is arranged in a spiral from the center, each layer of the strip being ¼ inch from the next. At the center is a round piece 2 inches in diameter that serves as a well for pouring in the solution. The spiral is laid out as shown by the table in the illustration by cutting notches that gain 1/16 inch from the center on each arm. After the first mark has been laid out on each arm, it is only necessary to mark spaces a quarter of an inch apart until the end of the arm is reached. Involved calculation is unnecessary.

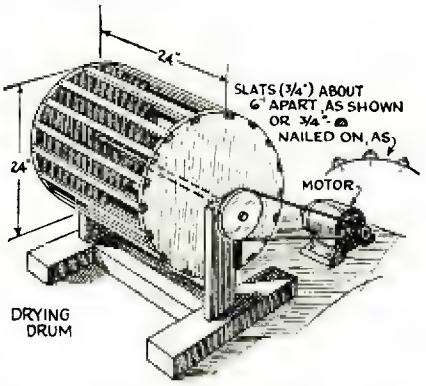

Fig. 7. Here is an illustration of a drying drum that the home movie enthusiast can make for his own use.

Four quadrants are cut out of brass so that they will fit into the spaces between the arms. The arms may be grooved to take these quadrants or they may be spot soldered to the stripping. These pieces form a bottom plate to prevent the film from sagging down below the strips and becoming tangled when the film stretches after being wet.

When the rack has been assembled, have the whole thing heavily nickel-plated or dip it in Probus paint (an acid-proof compound). This will prevent action of the chemicals on the strips and consequent spoiling of the developing solutions. The extreme diameter of this rack is twelve inches and it provides for a film capacity of almost seventy-five feet.

Three tanks must be made to hold the solutions for developing, fixing and washing the films. These tanks may be circular in shape, the inside diameter measuring twelve and a half inches; they are two inches deep. If desired, they can be made to nest, each tank of a different size, the smallest one twelve and a half, the next thirteen, and the last thirteen and a half. Then all three tanks and the rack can be stored together in a very small space. The tanks should likewise be nickeled or painted with Probus.

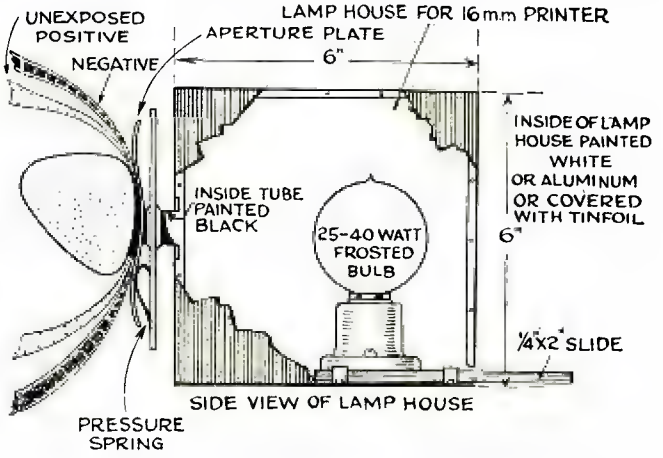

Fig. 2. Details for the making of a printer for 16 mm. film.

Photo by Herbert C. McKay

The tanks for the developing and fixing of the film are to be seen on the table top. This also illustrates the developing reel.

For developing the negative the formula known as Number 16 is the best to use. This formula will be found at the end of the article, together with the formula for the positive and for the fixing bath. These are printed together so that they may be cut out and pasted in the scrap-book.

(*Continued on page* 758)

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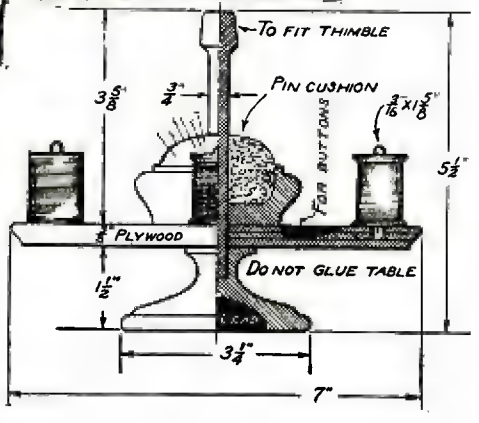
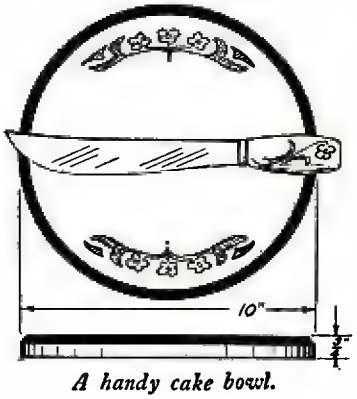
Christmas Gifts *from the* Home Wood Turner

By H. L. Weatherby

Home-made Christmas gifts should combine fine appearance with utility, and the sewing stand illustrated below is easily made by the home wood turner.

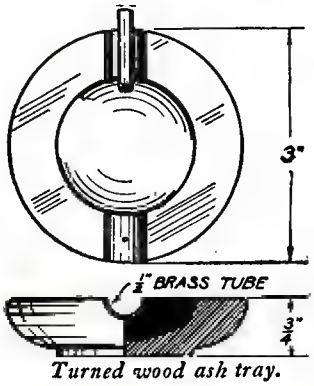




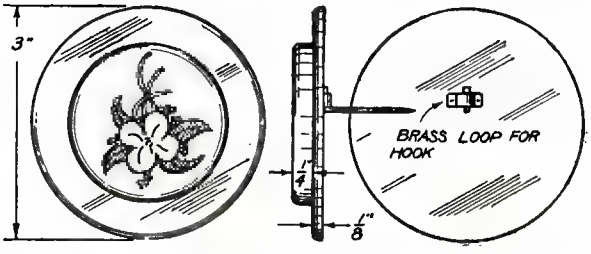
A handy cake bowl.

WITH the approach of Christmas and the making of gift lists, we are usually at a loss to know just what to give. Again, our pocket-books may not be able to stand the strain, and we dread to see the holiday season draw near. There are many useful novelties that can be made quickly and easily at home on the lathe by the wood-turner, and well-made and nicely finished articles made at home are the most acceptable of gifts. A few pleasant hours in the shop does the trick and, besides all of the fun and experience gained, the question of gifts may be solved in a large measure.

Most of the gifts illustrated will appeal to the feminine taste, even to the ash trays; however, they are all for the home and will prove to be very acceptable to all members of the family.



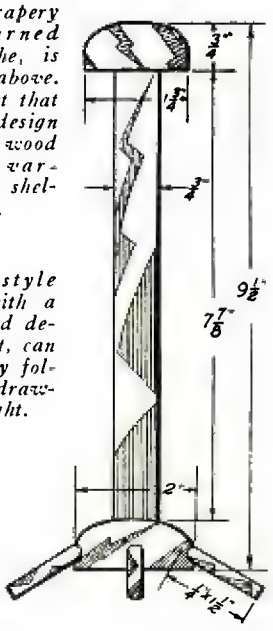
Turned wood ash tray.



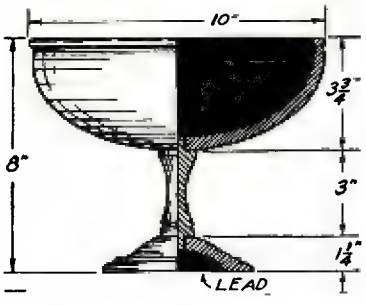
The Cake Board

ABOUT the easiest one of the group of articles illustrated is the cake board. It simply calls for the turning on a face plate of a flat, circular piece, with a bevel on the top side, careful smoothing up and decorating. The decorating may consist only of a two-color enamel combination on the edge and bevel, or in addition a spray of flowers may be painted on the top surface. A knife, that should go with it, to make the gift complete, should have the handle painted and decorated to match the board. It is quite likely that most housekeepers would prefer the top surface of the board simply sandpapered smooth and left free of decoration, so that the board could be thoroughly cleaned and scraped if desired. A close-grained, well-seasoned wood should be used and the size of the board, of course, is optional.

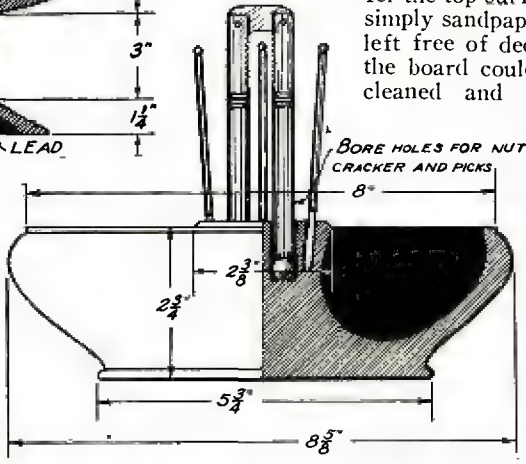
A neat drapery tie-back, turned in the lathe, is illustrated above. In the event that a transfer design is used, the wood should be varnished or shellacked.



A modern style hat-rack, with a gaily painted design upon it, can be turned by following the drawing at right.



A turned wood fruit or nut bowl is shown above.



Nut bowl and holder for the cracker and picks turned from wood; mahogany or walnut makes a very pretty job. The finish may be rubbed varnish.

Drapery Tie-Back Ornaments

A SET of these ornaments will appeal particularly to the women. Most curtains and draperies are held back near the bottom with tie-back pieces, which usually loop over a hook placed in the casing. These disks, painted in gay colors to match the window hangings, will add very much to the appearance of the room. The turning is a simple matter, and the decoration may be done with transfer designs by those lacking artistic ability.

The construction of the loop which holds the hook is clearly shown. The shoulder of the hook, any number of which may be purchased (Continued on page 754)

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How to Make Rayon

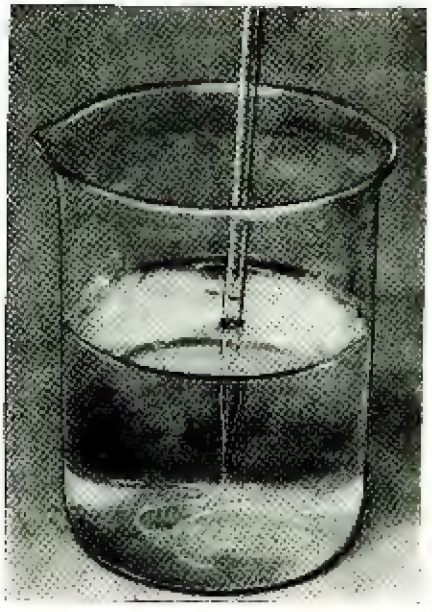
By Raymond B. Wailes

ONE would think that such a scientific and technically controlled process as the manufacture of artificial silk could not be duplicated by the amateur chemist in his little home laboratory, but quite the contrary, the actual manufacture of threads of this new industrial fibre is really possible as a laboratory demonstration.

Rayon, or artificial silk, can be made in the laboratory by dissolving purified or cleaned wood pulp or cotton in a solution of a copper salt and then squirting this chemical solution through holes into an acid or alkaline solution. This latter solution precipitates, as it were, threads of the artificial silk, which are then washed in water and dried. the drying often being done under tension.

Although the laboratory preparation of artificial silk, or rayon, will not yield fibres which may be woven into cloth, the process is easily carried out, and positive results are usually the outcome of even the most careless laboratory technique.

The first step in this beautiful experiment is to prepare a solution of cellulose (cotton or wood) in a copper salt solution. The copper solution is cupro-ammonium sulphate and can be easily made by dissolving copper hydroxide precipitate in very strong ammonium hydroxide, the stronger the better. The precipitate of copper hydroxide will immediately dissolve, forming a deep blue solution. This deep blue solution has the curious property of dissolving cellulose. Cotton, wood and paper are cellulose, and it will be found that if a sheet of filter paper is dipped into the solution, it will become pasty and disappear.



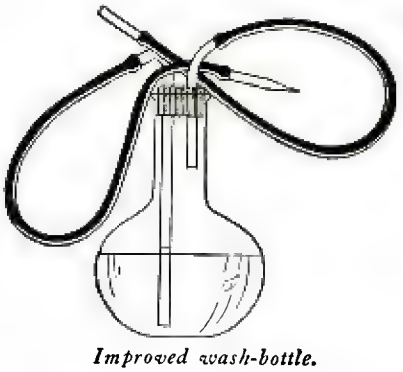
Blowing the cellulose solution through a small hole into a ten per cent. solution of sulphuric acid produces the rayon threads.

Filter paper dissolves in the copper salt solution.

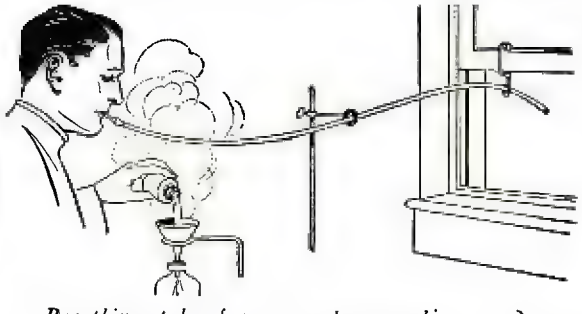
To squirt the threads, take an ordinary pipette and suck some of the cellulose solution up into it and thrust the tip of the pipette down into a weak sulphuric acid solution. Blow from the upper end of the pipette, and the cellulose solution will be squirted out through the hole in its tip and instantly be changed into artificial silk. The threads should be collected while moist, washed and dried.

Short-Cuts for the Young Chemist

A WASH-BOTTLE that will stand on the table while in use, leaving both hands free, is obviously an advantage. Such a wash-bottle is shown in the diagram. The rubber tubing may be made any convenient length.

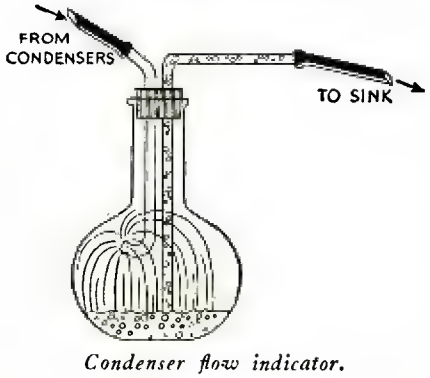


Improved wash-bottle.



Breathing tube for use when working with chemicals that give off dangerous fumes.

An indicator that will show when water is flowing through the condenser during a distillation may be made from a small flask, some rubber tubing, a rubber stopper, and some pieces of glass tubing.

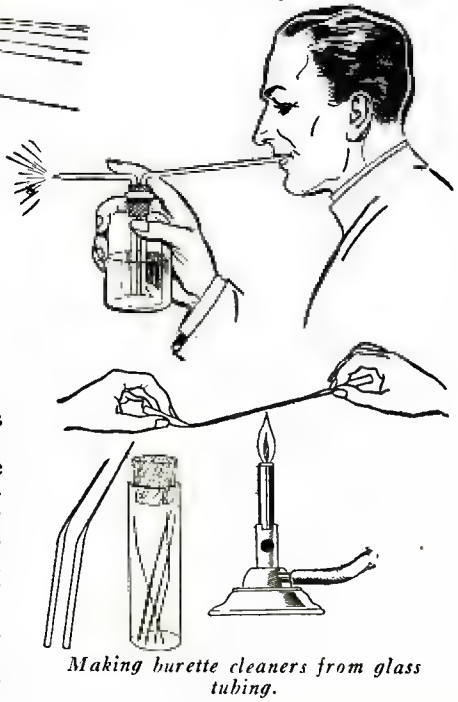


Condenser flow indicator.

Chemicals of the halogen group give off dangerous fumes in different combinations. It is, therefore, necessary for the chemist to have some means of getting fresh air. A glass mouthpiece and rubber tube extending outdoors will allow him to breathe fresh air.

Several small wash-bottles like the one shown will have many uses in the amateur chemist's laboratory. They are handy and at the same time make it unnecessary to contaminate the regular wash-bottle containing distilled water.

Wash-bottle to use to avoid contaminating the regular wash-bottle.



Making burette cleaners from glass tubing.

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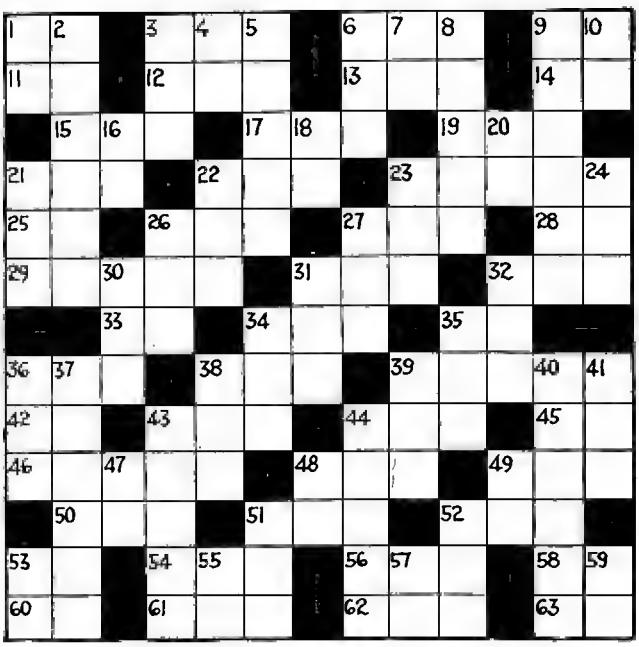
Test Your Mathematical Knowledge on this CROSS-NUMBER PUZZLE

By Richard Hoadley Tingley

JUST to start you off, we will give the answer to the first "across" line at 1; the answer is 33, twice the value of 1 pole, which is 16½ feet. Now proceed with the rest of the problems. Try to solve every one before turning to the answers on page 763.



ACROSS

1. Two poles.
3. Multiply the first of the "teen" numbers by seventy. Then subtract two.
6. Simple interest on $100 at 5 per cent. for one month. In cents. Decimal point in front first figure.
9. The age at which a girl is said to be "sweet."
11. Maiden loved by Zeus who was turned into a heifer by the jealous Hera.
12. Add twenty to thirty two times the cube of three.
13. The 3rd, the 12th and the 22nd letters of the alphabet placed in a row.
14. The next to the last of the "teen" numbers.
15. Half of D.
17. Add four and eight tenths to one and six tenths times the Fahrenheit boiling pt. of water.
19. One less than M.
21. Three hundred dollars less than the monthly salary of a United States Cabinet officer.
22. Twenty-four divided by sixty four. Decimal point in front.
23. Ten times the date of the Norman Conquest, plus two thousand.
25. The number of degrees in a quadrant.
26. Add thirteen to the date of the Hegira.
27. One and eight one hundredths less than the square of the number of square feet in a square yard. Decimal point after the first figure.
28. The slang expression for a five-dollar bill and the chemical symbol for carbon placed one after the other.
29. Multiply the foot-minute pounds in a horsepower by 2.065234. Nearest whole number.
31. Divide MDCCCIX by three.
32. The abbreviation for the part of the country where the capital of the United States is situated.
33. Twenty-four thirty-seconds, expressed decimally.
34. The symbol in chess for castelling on the queen's side.
35. Add four to the age of Benjamin Franklin when he died.
36. Six more than ten times an abbreviation for the Lehigh Valley (Railroad).
38. Nine hundred years before George Washington was born.
39. Sixty feet less than the height of the highest mountain peak in the world—Mt. Everest.
42. The number of rods in two furlongs.
43. Charlemagne was crowned King of the Franks and Emperor of the Romans eight years before this date.
44. Six and a half times the chemical symbol for chlorin. Capitalize last letter.
45. Two.
46. The number of square feet in an acre.
48. Fourteen less than the square of twenty-six.
49. The number of acres in a square mile.
50. The cube of eighty-five one hundredths. Decimal point in front.
51. Seventeen hundred years before Napoleon met his Waterloo.
52. The number of cubic feet in a cord.
53. Divide the year when the World War began by 47.85.
54. Six less than M.
56. Goods cost $2.50 a yard; how much will 3.54 yards cost? Decimal after the first figure.
58. A baker's dozen.
60. Three score and ten.
61. Suhtract forty from six gross.
62. Twenty less than twenty perches.
63. Number of days from January 1st to March 30th. Not leap year.

DOWN

1. Add twelve to the last of the "teen" numhers.
2. Multiply the chemical symbol for didymum by 603.808. Nearest whole number. Capitalize last letter.
3. Twenty-four and a half times the number of perches in a furlong.
4. Divide six hundred and forty by eight thousand. Decimal in front.
5. Twenty-seven thirty-seconds expressed decimally.
6. Seventy less than one tenth of the number of square yards in an acre.
7. The number of men "on a dead man's chest."
8. Multiply the year in which Coolidge was elected President by 34.26351. Then subtract one. Nearest whole number.
9. Square three hundred and forty-five and add six hundred and sixty-five to it.
10. Four more than the square of the number of quarts in a peck.
16. The twelfth alphabet letter.
18. Ten less than President Hoover's age.
20. The number of ounces in eight Troy pounds.
21. One hundred years before the First Crusade started.
22. Interest on $10 at 5 per cent. for eight months, in cents. Decimal point in front of last figure.
23. Pre-war value of a gold French franc. In cents. Decimal after second figure.
24. Five one hundredths. Decimal point in front. Add a zero at end.
26. Eleven hundred years before the "Deacon finished his one hoss shay."
27. Forty-two minutes is what part of a degree expressed in decimals? Decimal point in front. Suffix two zeros.
30. CLXXVI.
31. The number of days from January 1st to August 25th of the year after. Not a leap year.
32. Add the number of rods in a furlong to the number of acres in a square mile.
34. Five per cent. interest on $3.00 for three months in cents. Decimal point in front of last figure.
35. The B. C. date occurring four hundred and five years before the Battle of Marathon.
36. Eight more than the square of a couple of dozen.
37. Add the number of seconds in a degree to a half a million.
38. Ten times the boiling point of water by the Reaumur thermometer.
39. The number of days from January 1st to September 29th. Not in leap year.
40. Multiply 40.7409 by twenty thousand.
41. The chemical symbol for carbon and the twenty-fourth letter of the alphabet placed one after another.
43. Add 23138 to the number of inches in a mile.
44. Multiply 62.3118 by MDL.
47. The abbreviation for Long Island.
48. The twelfth letter, the twenty-fourth letter, and the personal pronoun first person singular placed in a row.
49. Thirteen less than six bits.
51. The square inches in a square foot.
52. One tenth of the abbreviation for the state of which Annapolis is the capital.
53. Four less than the chemical symbol for lithium. Capitalize last letter.
55. Fifteen and a third fathoms.
57. Three cubic yards in cubic feet.
59. Twelve more than the cube of three.

(Answers appear on page 763)

Useful Ideas for the Home Scientist

Water-proofing Paper

DISSOLVE 8 ounces of alum and 3¾ ounces of white soap in 4 pints of water. In another vessel dissolve 2 ounces of gum arabic and 4 ounces of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture and then hang it up to dry or pass it between cylinders.

The alum, soap, glue and gum form a sort of artificial covering which protects the surface of the paper from the action of water and, to a certain extent, from fire. This paper will be very good for packages which may be exposed to the inclemency of the weather.—*Eugene D. Yates.*

Iron Cement

THE following formula for cementing iron is very efficient and makes a strong, neat-looking joint.

Break up a pound of rolled sulphur and mix thoroughly with 1 pound of white lead, then add 3 ounces of borax and mix until you have a smooth mass. Take the quantity needed for the job and moisten with sulphuric acid. Apply a thin layer to both surfaces and put under pressure as in a vise or clamps. Let stand 24 hours.—*Mark L. Gluckman.*

Dish Protection in Refrigerator

TAKE a piece of sheet rubber packing or stair tread about 4 x 4 inches. Punch holes through it any size or shape that may suit you. This is used under dishes that are set on the ice to prevent them sliding off.—*Mortimer M. Epstein.*

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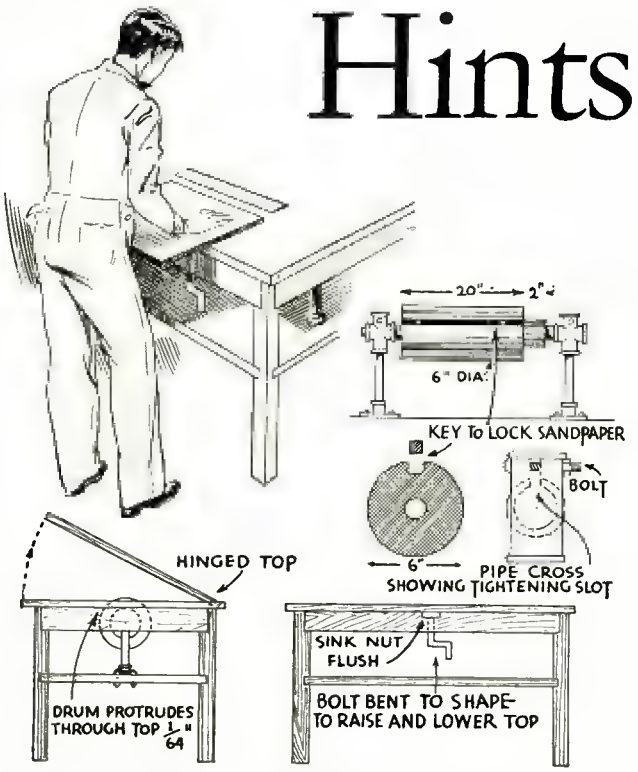
Hints *for the* Home



This 18-inch drum sander will prove indispensable to the home mechanic.

A Drum Sander rrom the Scrap Pile

First Prize $10.00

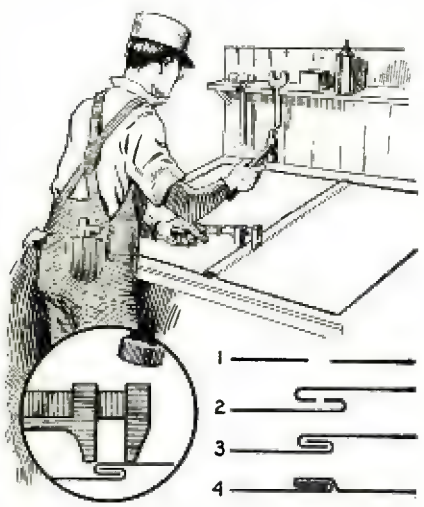
TWO crosses, two nipples and two flanges are needed to make the bearings of this 18-inch drum sander. Before assembling the fittings plug the nipples where they enter the crosses. This will save babbitt. Assemble the fittings and tighten until they are of equal height. To babbitt within a reasonable degree of accuracy cut a crotch in two pieces of wood, trim to desired length and nail to a base. Heavy box paper clamped on each side of the crosses will prevent the babbitt from running out at the ends. Insert the shaft through the crosses, allowing the ends to rest in the crotch. Pour the babbitt, stopping it ⅛ to ¼" from the top of the crosses. This space serves as an oil cup. Remove the shaft and drill holes through the sides of the crosses for stove bolts. With a hack saw cut through the top part of the crosses and babbitt. Insert the stove bolts with nuts and you have an excellent spring bearing.

For the drum a 6 × 6 piece of redwood or soft pine may be used. Locate the center of the lumber and bore half way through from each end. If this is done by hand it will be found that there is a slight variation where the holes meet which will make the shaft fit tight.

Round one end of the drum for a belt and assemble parts on block A. Clamp to the bench and turn to desired diameter. The pulley is turned on one end of the drum. A one-quarter horse motor is sufficient power for slow work.—*R. S. Glover.*

Use Monkey Wrench as Seaming Tool

A MONKEY wrench will lock any sheet metal seam within its scope. To use it for this purpose, simply fold the metal to the desired width, seam as the lock progresses. Lay the metal on something with a flat hard surface under seam, before starting to hammer.



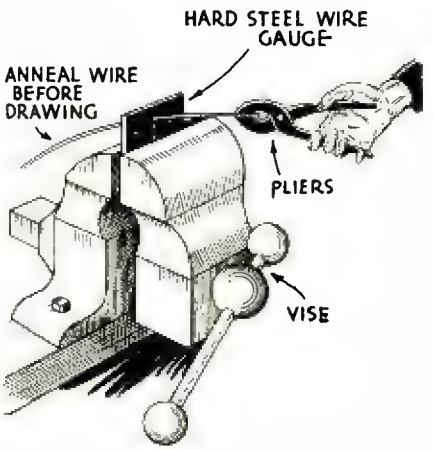
The drawing shows the four successive stages in making a lock joint between two pieces of sheet metal in the manner here described. First the edges of the two sheets are bent to the shapes shown at figure 2; next these two bent edges are interlocked as shown at figure 3. Finally the joint is locked as in figure 4, by simply holding the wrench over the ridge of metal formed by the juncture of the two folded bends, and repeatedly striking the wrench with a hammer as the man in the picture is shown doing.

then apply as shown. Adjust the wrench to the correct opening and tap with hammer as shown, moving along

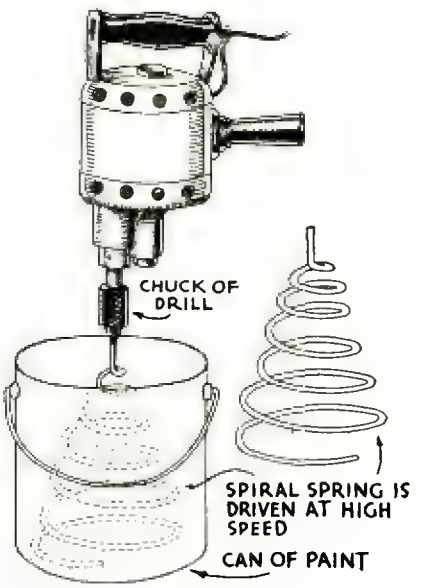
Reducing Size of Wire

WHEN small diameters of soft wire, such as soft iron, or spring wire of brass and german silver, are desired, anneal the wire by heating. Take an ordinary hard steel wire gauge and clamp it in a vise. Pass the end of the wire through, after filing slightly to reduce the end. With a pair of pliers, grip the end firmly and pull the wire through the gauge.

The wire may be reduced most any amount if the precaution is taken to anneal before each successive drawing. Try this novel means the next time you need a special piece of wire.—*G. A. Luers.*



Reducing diameters of small soft wire with steel gauge.



Paint mixing by means of motor-driven stirring rod.

Paint Mixing by Motor

THE writer recently saw a clever means for stirring paints and enamels, quickly, uniformly and less laboriously than that involving the use of a paddle.

A spiral-shaped spring was attached to a small electric drill and rotated by this means.

The operator had only to press the electric trigger of the drill and the improvised paint mixer went whirling around at high speed, mixing and smoothing out the paint without delay or exertion.

Such a spring for this use can be obtained from upholstered seats or is readily coiled from eighth-inch wire.—*G. A. Luers.*

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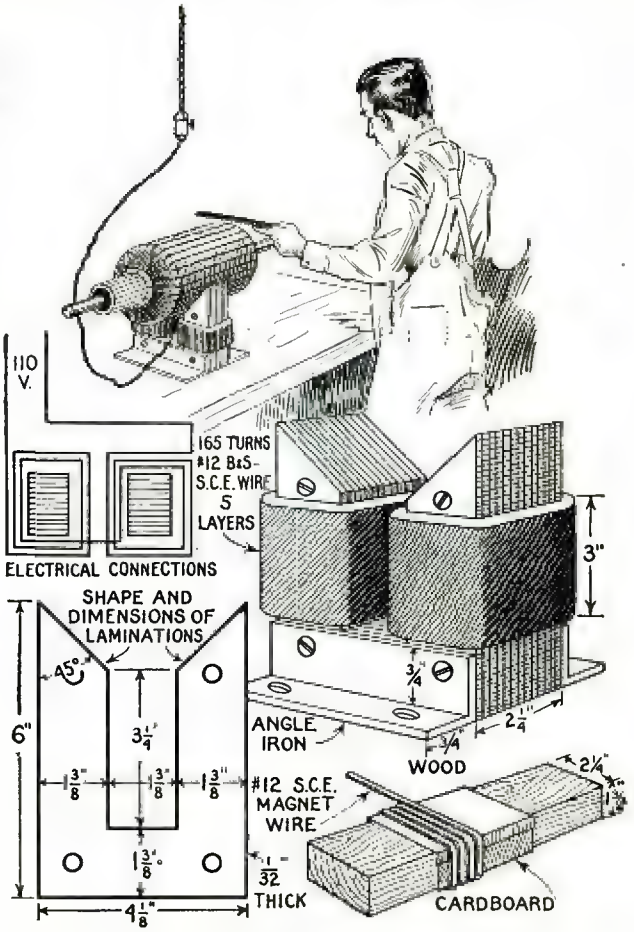
Workshop

Testing Motor Faults with "Growler"

THE growler herein described is a device for testing electric motor armatures for grounds, short and open-circuits. In this article a 110 volt A.C. growler will be considered; its principle is identical to that of the transformer. The windings on the armature become the transformer secondary, the iron armature core completing the magnetic circuit. Procure sufficient sheet iron about 1/32" thick, cut enough of these to the dimensions shown to make a thickness of 2¼". They are then clamped together in a vise and 4 holes drilled as shown. Cut and drill 2 pieces of angle iron and place these at the base of the assembled laminations and bolt them together. The two top holes are also bolted and the whole assembly is smoothed down with a file or emery wheel.

The coils consist of 5 layers (each layer containing 33 turns) of No. 14 B & S Gauge S. C. E. magnet wire, 165 turns for each coil, both being wound in the same direction and connected as indicated. They are then shellacked, taped and baked, and when thoroughly dried, placed on the core. The finishing ends should be flexible cord connected to an attachment plug.

Place the armature between the pole-pieces and insert cord plug in A.C. outlet. The armature is slowly revolved with one hand, while a small piece of steel (hacksaw blade) is held lightly on the top of the armature with the other. If there is a short-circuited coil, the blade will be strongly attracted to the slot carrying the defective coil, due to magnetic force caused by the induced current. The coil will also become noticeably hot. An open coil may be detected by shorting every pair of adjacent commutator segments. The bars that do not produce a spark have an open circuit. A grounded coil will produce a spark between the commutator and shaft when contact is made with a piece of wire.—*Hugh Bureton.*



Various motor armature faults can be located with this "growler."

Electric Glue-Pot

IN reading the August number I came across the pages devoted to Shop Mechanics and was very much interested in the other fellows' patience-savers, so I am submitting one of mine.

The heating problem of glue pots has been and is still the bug-a-boo for the back-yard cabinet maker. Before discovering the possibilities of a broken-down coffee percolator, I had depended on either a coal oil stove or rushing back and forth between the shop and gas stove.

One day I noticed that our percolator was not in use and on inquiry I was told that it was battered and broken beyond further household use, so like a lot of other discarded things it found its way out to the shop.

Some time later while building a little furniture I had to use the glue pot. I was out of coal-oil, so was getting prepared for the kitchen parade, when I noticed the old percolator and an idea dawned. I filled it up with water and plugged it in and the experiment was more successful than I expected. Since then I have cut the percolator down and made a glue pot to fit it, and have sure enjoyed it.—*A. L. Leonard.*

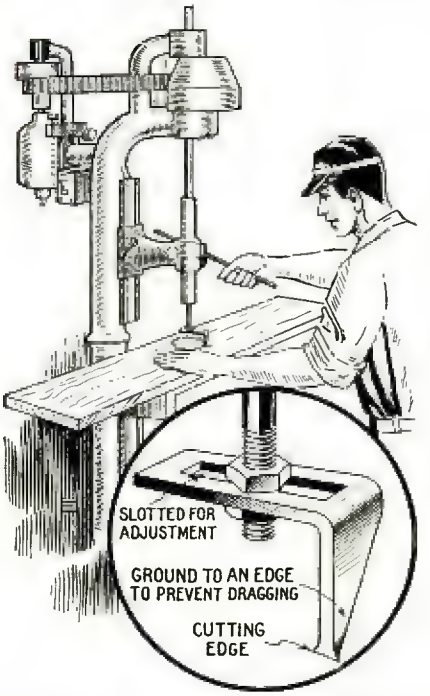
Remove handle of percolator and cut at dotted line; make glue pot with flat rim that extends over side of percolator.

$10.00 MONTHLY FOR BEST HINT

SEND us a photograph or sketch of your own hint for the home workshop. $10.00 is paid monthly for the best hint accepted and published. Others that we publish are paid for at regular rates. Here is a chance for you to win a prize for a useful workshop hint.

Home-Made Circle Cutter

THIS home-made tool, used in connection with a drill-press, cuts neat holes up to eight inches in diameter in wood up to four inches thick. Bore a small hole for center and cut half way through from each side.—*R. L. Allen.*



A circle cutter is easily made after the simple manner here illustrated.

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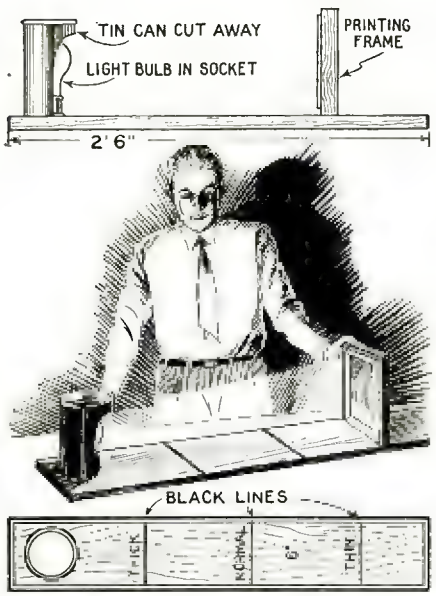
How-to-Make-It

Photo Print Guide

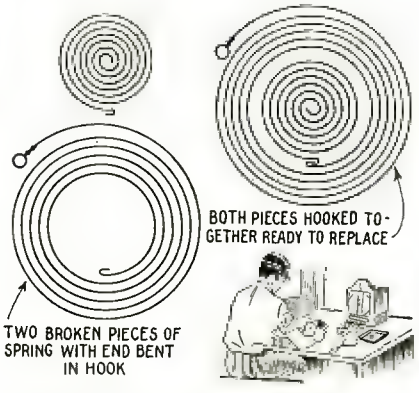


An easily made guide for making photo prints is illustrated above.

YOUR films can be roughly divided into three groups. Some are under-exposed. Others are over-exposed and, we hope, most of them are of normal density. This guide which will enable you to make the right exposure with only the clock to watch, consists of a single board 30 inches long and 6 inches wide, and a tin can. Cut one side of the can away as shown and set it up on the board at one end. Mount a light socket inside and run a cord from this to the outside, through a hole in the edge, so that it can be connected to a light plug in the house. Paint three lines evenly spaced. Mark the line closest the can "Thick," the middle line "Normal" and the third "Thin," meaning — thick, normal and thin films. When you put a film in the printing frame note its density. If it is thin, or under-exposed, then set on the third line and expose a uniform time of 10 seconds, or whatever time you have found to be the best with the bulb you are using. If the next film is thick, set the frame on the first line, and so on.—*D. R. Van Horn.*

Mending Broken Springs

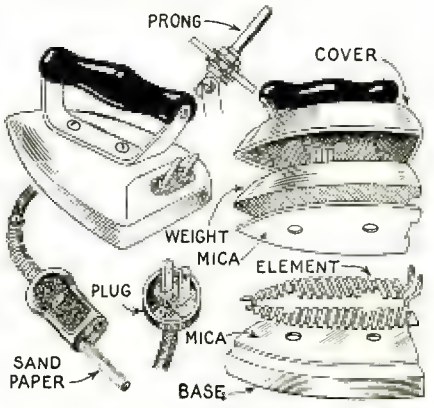
TO repair the spring, heat both ends in a clean flame till they are red, then bend both ends with pliers while red in a hook as shown, making them as flat as possible. Hook both together and replace.—*Donald Gilmour.*



The two pictures above show both inner and outer parts of a broken clock or other spring, with hooks bent on annealed ends before and after joining the hooks, thus making temporary repairs.

This method, though satisfactory, is not permanent, and may not work unless broken ends are very flat.

Repairing Electric Irons

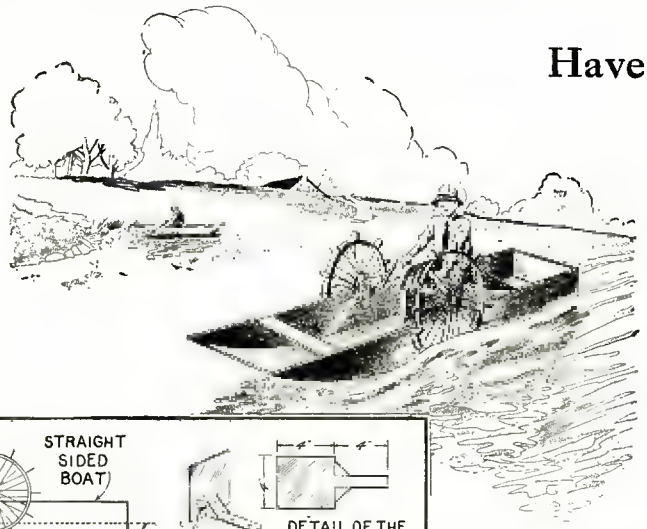


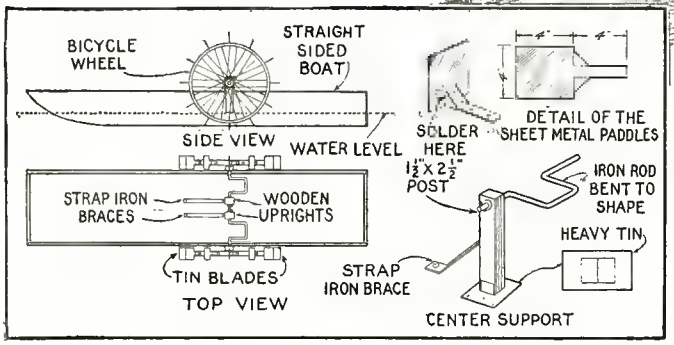
Various parts of an electric iron are shown clearly above.

ELECTRIC iron troubles can be placed in three classes: (1) Iron does not heat at all. (2) Blows fuses. (3) Iron does not heat to proper temperature. The first trouble is caused by a break in the circuit somewhere. The element may be burned out and in this case a new one must be installed. The connections where the element connects to the prongs may be broken or burned off, or the cord may have a break in it. Examine carefully the connections in the attaching plugs at the ends of the cord. On account of the high heat attained, these connections must be carefully watched and the plug re-set if they are found to be in bad condition.

If the iron blows fuses, there is a short in the iron or cord. Sometimes the bare wires become twisted or otherwise come in contact with each other in the socket plug.

Have Sport With This Buck Boat





This little buck boat is propelled by means of two paddle wheels, the wheels being operated independently, by means of cranks which are turned by hand. No rudder is necessary.

THE buck boat is a straight sided boat, preferably home-made and of a medium size with paddle wheels. These are turned with the hands and will send the craft at a good speed through the water. No rudder is needed, because all you have to do to turn the boat about is to stop turning one wheel while the other is kept turning. To speed up the turning process, one wheel can even be reversed. By reversing both wheels at the same time the boat can be brought quickly to a stop.

The mechanism is easily made. Two rods are required for the handles. These should be about ½ inch in diameter. One end is to be keyed or otherwise fastened into the hub of the bicycle wheel and then next in line is formed a crank as shown with about a 6-inch bend to give a 12-inch stroke. Each rod is nearly symmetrical except that the end projecting through the outside bearing is a little longer than the other and both rods must be shaped to fit the width of the (*Continued on page 755*)

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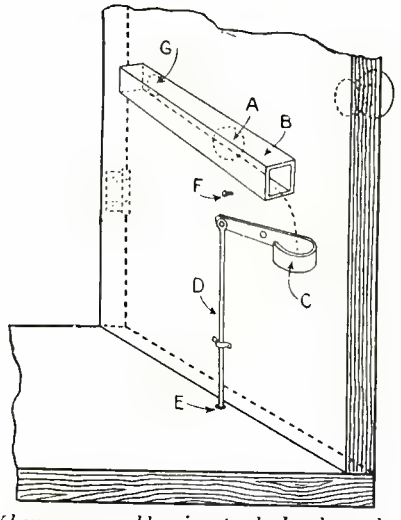
A Secret Lock

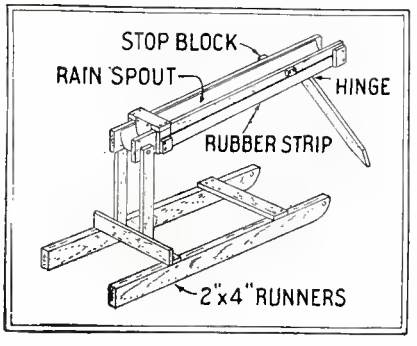


When a marble is pushed through a hole, G, into a tube, B, it runs down, and falling on lever, C, opens lock.

A VERY simple form of secret lock which hardly anyone will get wise to, is illustrated in the accompanying drawing. A simple pivoted lever and rod system, C, D, E, is employed and when a marble is pushed through the hole in the door, it falls down through the tube B, thence onto C and thus opens the lock.

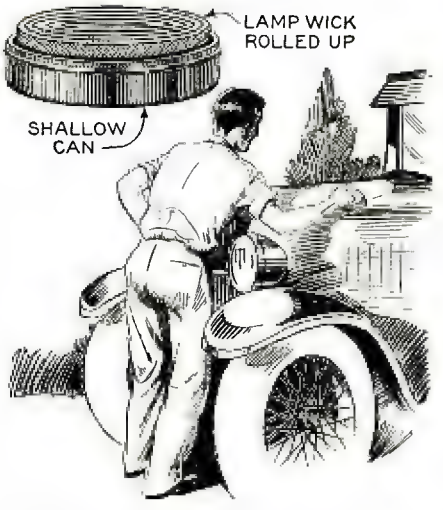
Snow-Ball Catapult

FIRST lay out the runners and across their tops nail a couple of cleats for braces. Nail a third board on edge to the rear of the back cleat, and to this nail two uprights of the same length, about 5 inches apart. Fasten two boards to the tops of these, each 5 feet long, and between them fasten with brads, a section of rain gutter or strip of curved tin. A cleat nailed to the lower side of these at the front holds the hinge. To propel the ball, a special piece of stiff sheet iron is cut out, with its lower end rounded. The upper edge is nailed to a wooden slide to which side guide strips are nailed. Then on each side the rubber strips are fastened.—*D. R. V.*



A simple snow-ball catapult.

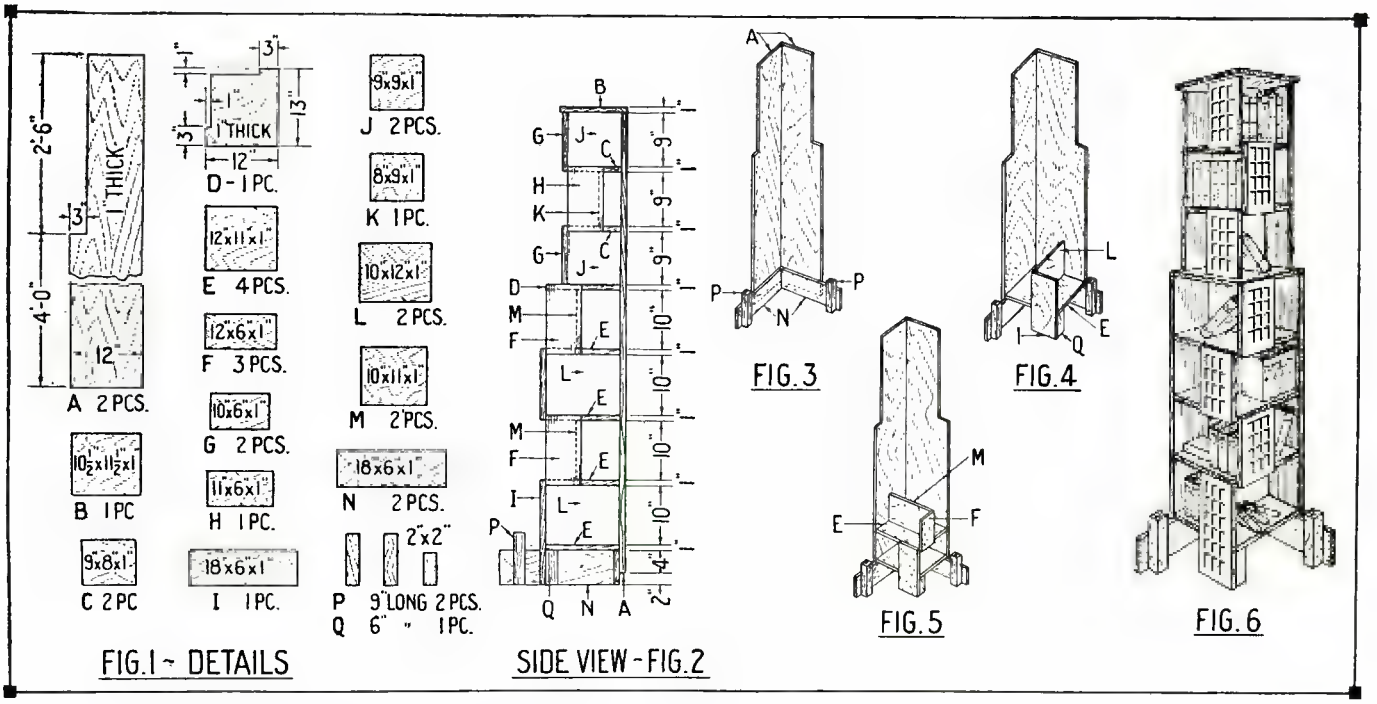
Car Polisher



Lamp wick rolled up in can makes a good car polisher.

COIL a length of ordinary cotton lamp wick into a roll that fits into a shallow metal can, such as a wax polish box, with half the width of the wick projecting from the can. This makes a pad that can be saturated with polish or liquid wax for readily re-polishing the automobile. When not in use cover the can to keep out dust and prevent drying of the polish.—*K. B. M.*

How to Build a Skyscraper Bookcase



The dimensions of the various pieces of wood employed in building this skyscraper bookcase are clearly shown, as well as their assembly.

THIS bookcase has a shelf capacity of nine feet. If you make it yourself, from white pine, it will cost about $4.00. Only forty feet of lumber are required, and 100 2-inch wood screws (40 round head), plus wood dye, white or orange shellac, and a little black paint.

Figure 1 shows dimensions of all wood pieces for a case 7 ft. high. Caution: in making pieces "C" and "D," make one-half of each batch of pieces with the wood grain running in one direction and the other half with it in the opposite direction, the mechanical strength will rest entirely upon assembling the floors ("C," "D," or "E") such that the floor grain runs perpendicular to the upright partitions ("I" or "J").

The uprights "A" are screwed and glued together. Notice in Fig. 3 that the uprights "A" do not touch the floor—there is a clearance of 1½ inch or so, indicated by the dotted lines. The sequence in building a story is, first lay the floor "C," "D," or "E"; second, put in the upright partitions "I," or "J"; and third, fasten the vertical truss "F," "G," or "H."—*Esten Moen.*

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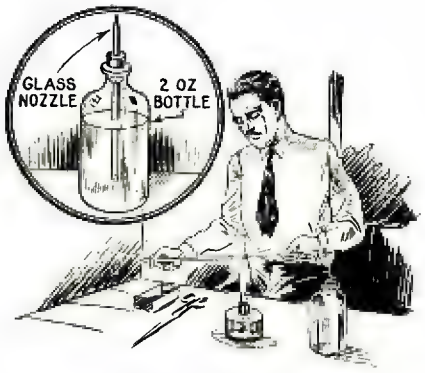
WRINKLES



"Dropping" Bottles

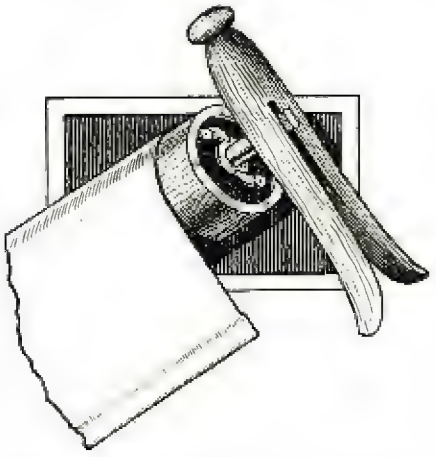
HANDY dropping bottles can be made by inserting tubes through holes in corks. The glass tubes are drawn out in a flame to a fine point or nozzle. The opposite end dips into indicator solution, etc. In handling glass tubing in a flame, rotate the tubing and move it back and forth so as to evenly distribute the heat and thus prevent cracking.—*F. R. Moore.*

Tooth-Brush Holder

TOOTH BRUSHES may be kept clean by placing them in a test tube or vial. Tooth-brush holders of this type should have a ventilated cork or cover.—*Frank R. Moore.*

Wrench for Shade Rollers

WHEN the window-shade falls or is drawn so far that it locks, use a clothes pin as a wrench by inserting the flat projecting end of the shade roller in the groove of the pin. The shade is rewound and replaced without the necessity of first rolling up the shade, placing it in the lock, unrolling it and then rewinding. If the shade is locked by being drawn down too far, use clothes pin to move the spring slightly to permit loosening the ratchet.—*August Jeffers.*



How clothes pin serves as a wrench to adjust shade springs.

Tin-Plating Iron

MANY a person has experienced great difficulty in making tin adhere to the surface of an iron object that was to be tin-plated. This condition can be satisfactorily remedied by the following process.

Clean off the iron surface first by pouring dilute sulphuric acid over it and washing it with plenty of water and then rubbing with sand until it is perfectly smooth and clean. When this operation has been concluded, apply a solution of chloride of zinc, the so-called soldering acid.

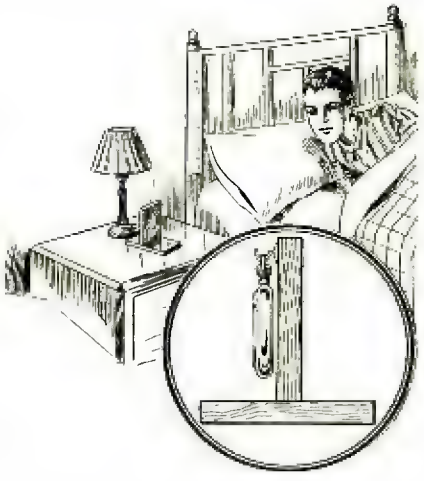
When an object, the surface of which has been prepared in the above manner is dipped into molten tin, the tin will adhere easily to all parts. This method is the best practical method for use in tin-plating iron that can be found for the amateur mechanic without expensive apparatus in his shop. The acid and zinc solution must be handled with care, especially the acid.—*Neil H. Tasker.*

A Cheap Generator Overhaul

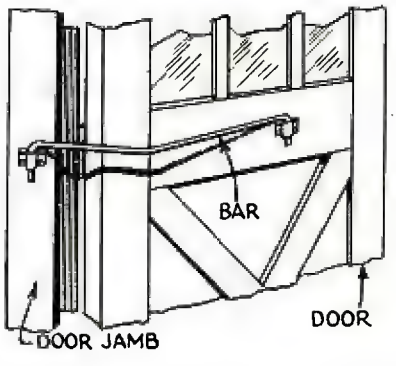
WHEN sandpaper fails to liven the ammeter needle, it is usually necessary to have the commutator "turned down" on a lathe. But a lot of fellows like myself have no lathe and would like to fix it themselves. Here is what I did on a Ford. I disconnected the generator wires and removed the metal strap that keeps out dust and covers the commutator. Instead of using sandpaper, I inserted a file, just the width of the commutator, while the engine was throttled down to its lowest speed. The file must be kept on the commutator only and not on any engine or body parts. Commutators do not generally wear out of round, so if an even pressure is kept on the file an almost perfect job will result. When the commutator surface is bright and shiny all over stop filing and remove the generator from the car. Take generator apart and with a piece of hack saw blade undercut the mica insulation on the commutator very carefully. If installing new brushes, sandpaper them on the new surface and set them in the brush ring. Before assembling the generator all parts should be wiped clean from filings, gummy oil or dust that may be on any parts. Reassemble the generator and replace it on the case. Connect the battery terminal and then adjust the output with the third or small brush.—*Frank Placerean.*

Watch Holder for Bedside

TWO pieces of wood placed at right angles, varnished and trimmed, makes a handy watch holder. The watch is held in a vertical position during the night, which is the best position for satisfactory timekeeping. Another idea is to place a small flashlight bulb in front of the watch and a small battery back of the upright, together with a suitable push button or switch. This will provide a very convenient and useful time indicator in any bedroom.—*K. B. Murray.*



To Hold Garage Doors Open



A simple iron bar, bent to the shape shown, serves to hold garage doors open.

MANY a garage is built where it is inconvenient or impossible to plant posts to hold the door open. George Dolby of Saco, Maine, built such a garage, and here is how he solved the problem. He fastened a socket to each door and door jamb. Taking a three-foot iron bar, he had a hook formed on each end and the bar bent in the middle. When the doors are opened, the two iron bars are dropped in their sockets and George Dolby's "patent," as he laughingly calls it, holds the doors open against the strongest wind that blows.—*Edward Cloudman.*

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and RECIPES

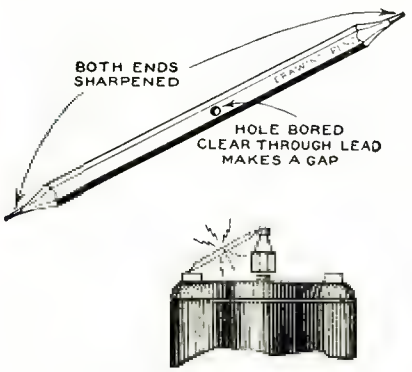
Shading Drawings Without a Pen

IN the making of ink drawings, it is sometimes desired that a portion be shaded, which is a tedious process with pen and india ink. Make a *dusting box* as illustrated, with a wire shelf near the bottom to support the drawing. In the box is placed a spoonful of black resin dust, made by coloring melted resin an intense black and pulverizing it when cool. The drawing should be covered with a (paper) cut-out mask, protecting all parts of the drawing that are not to be shaded.

Shake the resin in the box well and then insert the drawing on the wire shelf. In a few moments the exposed parts of the drawing will be covered with minute black dots of resin. When the shading thus obtained is sufficient, the drawing is removed from the box and gently heated, when the resin will melt and make the shading permanent. —*K. B. Murray.*

Spark Tester from Pencil

THE illustration below shows how to make an efficient spark plug tester. A hole is drilled exactly through the center of a pencil, giving two distinct electrodes; when the two pencil ends are touched to the engine frame and the spark terminal respectively, the spark jumps in the hole if the plug is O. K.



An easily made spark plug tester constructed from a lead pencil.

Drilling Holes Through Glass

TO drill glass, prepare a solution of camphor in turpentine and add some ether. While proportions are not very important, a good solution is made by taking spirits of turpentine, 1½ oz.; camphor, 1 oz., and ether, 3 drams. Break the tip from a three-cornered file so as to have a sharp and very hard point. Dip the tip of the file in the solution and give it a twisting motion on the glass where the hole is to be made. Use sufficient pressure to cut the glass, but do not break it. Practice will soon enable you to do the trick. Work on odd pieces of glass till you get experience. Be very careful when the tip of the file is about to come through the glass. After the hole is made it can be enlarged to any size by a round file. Keep the glass constantly wet with the solution.—*Charles McFarland.*

$5.00

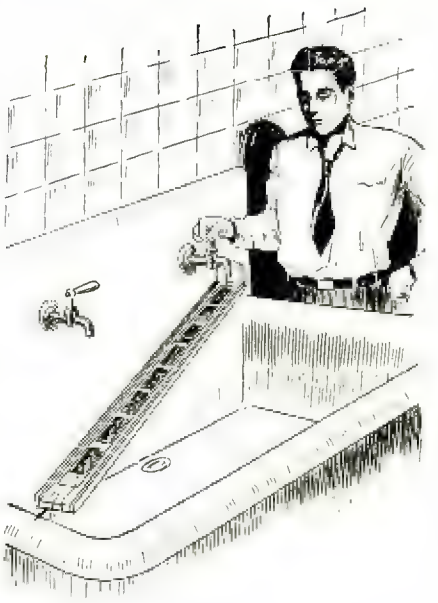
will be paid each month for the best wrinkle or recipe submitted to the editors and which they accept and publish in these columns. All other ideas accepted and published in this department will be paid for at regular rates. Address your ideas to—*Editor Wrinkles and Recipes.*

A Solvent for Rust

IT is often very difficult and sometimes impossible to remove rust from articles made of iron. Those which are most thickly coated are most easily cleaned by being immersed in a solution, nearly saturated, of chloride of tin. The length of time they remain in this bath is determined by the thickness of the coating of rust. Generally 12 to 24 hours is long enough. The solution ought not to contain a great excess of acid, if the iron itself is not attacked. On taking them from the bath the articles are rinsed, first in water, then in ammonia, and quickly dried. The iron, when thus treated, has the appearance of dull silver. Polishing gives it its normal appearance. — *Charles McFarland.*

How to Put Brown Finish On Gun Barrels

A SIMPLE preparation for the browning of gun barrels may be made from tincture of iodine, diluted with one-half its bulk of water.—*Vernon V. Johnson.*

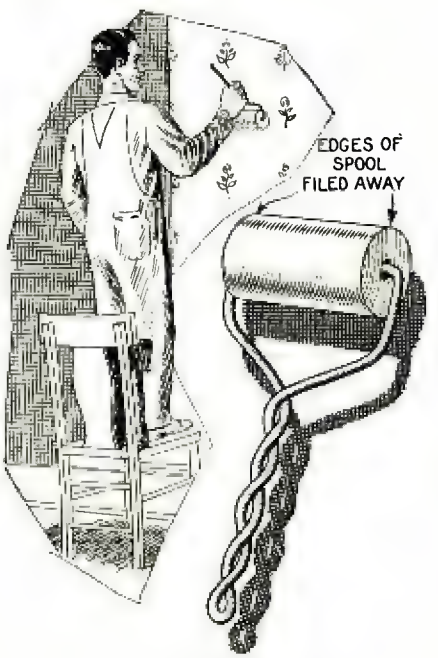


How to Wash Films

FILMS and plates can be washed entirely clean in a quarter of an hour by placing them in a trough made of a flat board with side pieces. Film in the strip can be pinned to the board at the upper end and the board suspended in the sink with the upper end at an angle under the faucet. This saves water, as but a small stream is necessary, and the method is twice as quick and certain as any other.—*K. B. Murray.*

Useful Wall-Paper Roller

A ROLLER such as used by paper hangers to level the wall paper from paste lumps, and to smooth the finished work, may be made by smoothing down the edges of a large spool with an emery wheel or file. The handle is made by twisting a piece of strong wire into the shape as shown in the illustration. The wire handle on a large syrup can will do.—*Louis Andrews.*



If you do any wall-papering, then you need this roller.

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Readers' Opinions and Comments Will Be Welcomed by the Editors

What Our

Perpetual Motion Solved!

Editor, SCIENCE AND INVENTION:

In SCIENCE AND INVENTION MAGAZINE you offer to give $5,000.00 for perpetual motion. This is what I call perpetual motion. Kindly send me the $5,000.00. Here is my solution:

Electrons and atoms moving in a molecule are perpetual motion.

JOHN PICONI,
McKeesport, Pa.

(Unfortunately our contest calls for a demonstration of a working model of a perpetual motion machine. You cannot demonstrate electrons or atoms moving in a molecule. We can demonstrate the Brownian movement, which comes closer to a demonstration than your device, but this likewise is not a machine. We are acting in good faith. There is no catch to our proposition. We therefore anticipate that perpetual motion inventors will act accordingly.—EDITOR.)

Likes Chemistry

Editor, SCIENCE AND INVENTION:

I have been a reader of SCIENCE AND INVENTION for a year and a half and will keep on getting it until the last publication. Being an amateur chemist, I enjoy the chemical experiments. As soon as I receive it, I turn to the "contents" page and look for chemistry. I think Wailes is an excellent writer and knows his chemistry and physics. I especially enjoyed the "Absorption" and "Experiments with Acetic Acid" articles. The next thing I turn to is Scientific Humor, where I get a good laugh out of Scienty Simon. The jokes are well chosen, which makes them quite enjoyable. I like to see fat people laugh, because there is so much of them to enjoy it. Hoping you are fat,

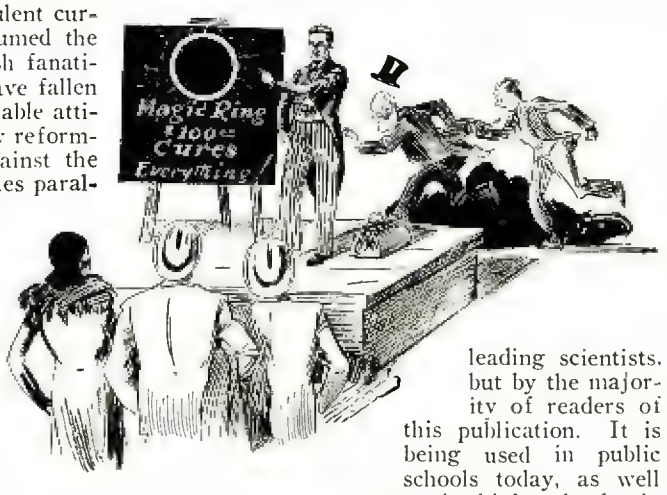
HERBERT F. WIESE,
1308 E. 141st St., East Cleveland, Ohio.

(Mr. Wiese hoped that we were fat because he included some jokes with his communication. If he ever saw the Joke Editor's face, he would wonder how a person so solemn and thin would ever sit in the chair of the Joke Editor. Perhaps some of the humor is so pathetic that it produces the lines of worry and care on this individual's smileless countenance.—EDITOR.)

Anti This and That

Editor, SCIENCE AND INVENTION:

Your utterly unjustified attack on alleged fraudulent curative devices has assumed the conditions of a childish fanaticism. You seem to have fallen in line with the despicable attitude of the present-day reformers; your crusade against the above-mentioned articles parallels that of the "Purity League," "Anti-Nicotine League" and countless other "Antis."



Such an attitude inevitably characterizes narrow-mindedness. Just why anyone should attempt to regulate or modify the life and actions of someone else is not discernible to one of the intellect. I am willing to admit that a vast number of the population of the country are incapable of governing themselves to best advantage, but to attempt to control them to the point where they may not even spend their money as they please is absurd. Admitting that the devices which you pronounce fraudulent are really so and have no actual curative power, still anyone who is sufficiently ignorant to succumb to the wild claims and advertising propaganda of the dispenser has a possibility of being benefited by sheer imagination.

While I am as firmly convinced as you of the uselessness of these products, I do not believe that one should be too hasty in condemning them. What harm is done by them, other than separating some illiterate and superstitious human of some of his worldly goods, which, were the specific product of his choice not available, would be spent for something equally useless? But you, in your disbelief in the merit of these contrivances, must attempt to completely efface them, thereby helping to make the world safe for hypocrisy.

L. P. BERNARD,
Royersford, Pa.

(We do not presume to dictate to the entire populace of this country what they should do with their money. We feel, however, that the public is entitled to know the facts. When an advertiser deliberately misrepresents, when he makes misleading claims, when he garbles science so as to make it fit a distorted theory on the control of various diseases, when he makes a statement ostensibly scientific, but which is purely buncombe and piffle, it is time that some publication or some organization exhibit spirit enough and backbone enough to bring out the false claims and show them in their true light. We believe that pseudo-science is far worse than no science at all.

SCIENCE AND INVENTION MAGAZINE is an educational institution. It has been so characterized not only by the leading scientists, but by the majority of readers of this publication. It is being used in public schools today, as well as in high schools, in the science classrooms and for collateral reading.

Anyone of us "sufficiently ignorant" has a perfect right to get the facts. We strive merely to educate the public. We strive to bring forth the ridiculousness of misstatements found in advertising propaganda for systems supposedly based on scientific principles for the cure of illness and disease. Is the fact that a man is illiterate an excuse for separating him from his hard-earned cash? We will leave further comments upon this letter to any of our readers who may have been benefited or injured by our exposés.—EDITOR.)

Is a College Education Worth While?

Editor, SCIENCE AND INVENTION:

After spending thirteen years in college, the writer feels that he might make a few comments.

A number of years ago a young man came to me and said that he had only one year of high school, had been working for several years and wanted to return and, after graduation, take a college education. This would mean at least seven years to him. He was at the time receiving a salary from the rail-

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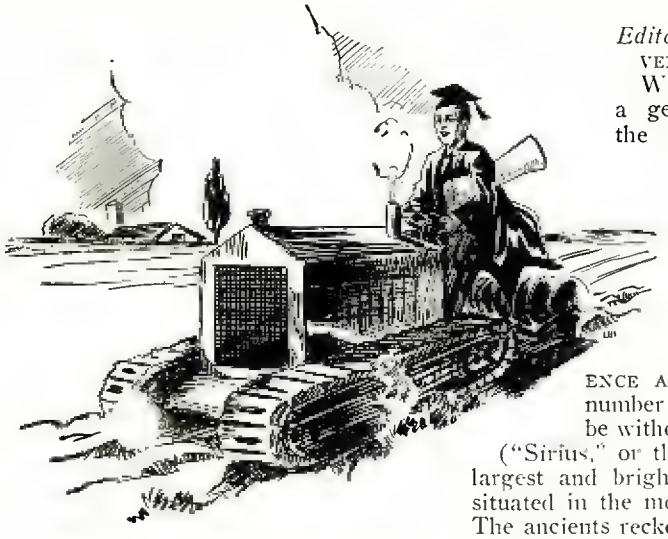
Readers Think

Questions and Discussions of General Scientific Interest

road of $1,200 a year. This would mean a loss of some $9,000 in salary, would cost him about $5,000 plus a probable increase in wages and when he got out he probably would not get a salary equal to the loss of interest on this amount of money and the probable increase plus his present one. Eventually he would be the loser.

In many cases we find that men are the losers by a college education. In other cases, perhaps they are the gainers. A man in college loses personal contact with business men; he figures only in the classroom. He does gain many friendships. He can look at life from a different aspect. He can fit into different companies and his reading vision is enhanced. As an example, a young man once asked the dean of an



agricultural school, "If I go to college, do you think I can return to the farm and make more money?" The dean answered him, "I am afraid you can," and explained to him that if he took a course in college he would be able to return to the farm and do the work with ten times more interest because he would know why he was doing each operation. This statement may apply in all fields of work to a young man who can afford an education.

A college education does not entirely make a man, but it adds much to his capital.

The president of one of our universities said, "If you educate a crook, you put tools into his hands for his work, but if you educate an honest man you do the same."

The days spent in acquiring a college education will never be forgotten, neither are the friendships made, and there are things that may not show themselves at once in dollars and cents that are of value and give pleasure in life. This everyone must consider in choosing a college education.

REED O. BRIGHAM, M.S., Ph.D., M.D.,
Toledo, Ohio.

(There is no doubt but that if both apply themselves to the task equally well, the college-trained farmer is by far more successful than the individual who uses the cut-and-try method. The man who has the soil of his field analyzed to determine whether it needs more phosphate, more ammonia, or more lime automatically knows exactly what he should apply, instead of waiting for the crops to come up and answer his question. The man who knows to what truck his farm is best suited, never makes a mistake in cultivating plants which could not possibly grow on his land.

But how many college graduates keep up their friendships after they have secured their diplomas? The alumni of many colleges will show you that the percentage is extremely small.—EDITOR.)

Dog Days

Editor, SCIENCE AND INVENTION:

Will you kindly give me a general description of the term "Dog Days"? When they appear? How long they last? Are they governed by the "Dog Star"? etc.

I might say that I have been a subscriber to SCIENCE AND INVENTION for a number of years and wouldn't be without it.

("Sirius," or the "Dog Star," is the largest and brightest of all stars and situated in the mouth of Canis Major. The ancients reckoned the "Dog Days," which are forty in number, as twenty before and twenty after the rising of this star. The rising of this star was supposed to presage extreme heat and the diseases incidental to this period. However, it was by mere accident that the rising of this star coincided with the hottest season of the year in the times and countries of these old astronomers. This star rises later and later every year because of precession and the time of its rising depends also on the latitude of the place. The time will come when the star will rise in the dead of the winter.—EDITOR.)

Nikola Tesla

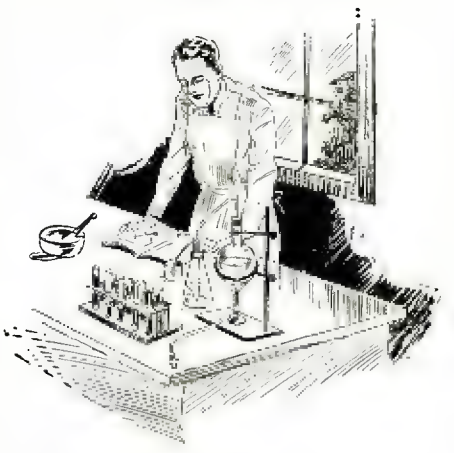
Editor, SCIENCE AND INVENTION:

Some years ago you published a series of articles on the inventions of Nikola Tesla. Are copies containing this series of articles available, and what is Dr. Tesla doing at present?

S. W. HUNTER,
New York City.

(Back numbers containing the Tesla articles are not available, but you can consult them at most public libraries. Dr. Tesla is occupied right along in the development and patenting of new electrical and mechanical inventions. —EDITOR.)

Popular Magic



Editor, SCIENCE AND INVENTION:

I recently purchased your most wonderful magazine, "Popular Magic and Card Tricks No. 3," and have been more than pleased with its contents. The tricks explained are many of which the value alone would be worth more than what is asked for the book.

I am an amateur magician and I delight in collecting books, magazines, etc., on the art of magic. I have gotten most of my books for the sake of having them, but with your magazine it is different. I would like to ask you if you have volumes 1 and 2 of "Popular Magic" in stock.

JOSEPH S. COTTON,
Turner Falls, Mass.

(Unfortunately there are no copies available of volume 1 and volume 2, "Popular Magic," both by Dunninger.

It is likely that some of your magical friends would be willing to send you a copy should they happen to have two on hand. Should anyone have such numbers and should they care to dispose of them, we would be glad to forward the letters to Mr. Cotton.—EDITOR.)

(*Cont'd on page* 740)

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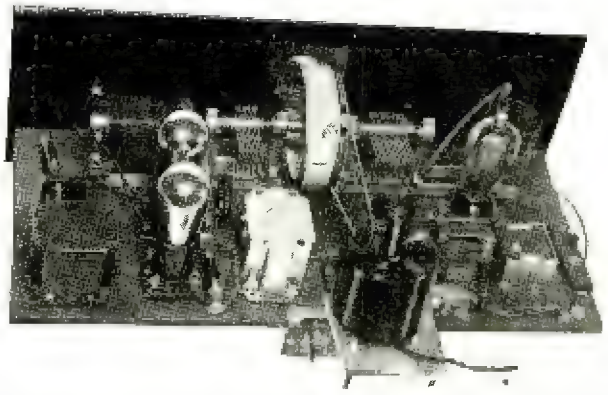
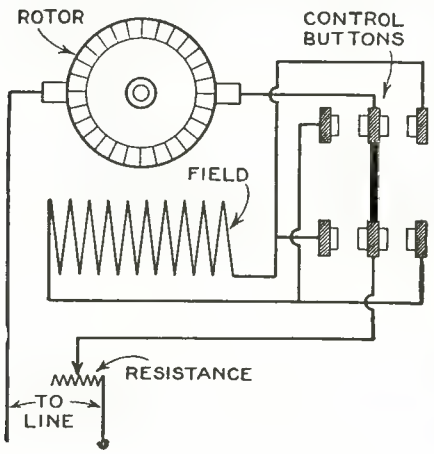
Remote Control *for the* Amateur

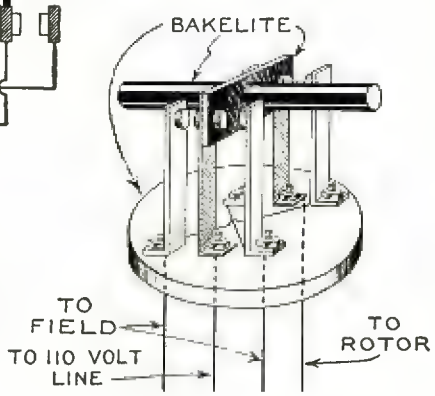


Above is rear view of set showing oscillating fan motor connected by pulley to drum of gang condenser.

LIKE many new improvements which have come to radio during its infancy, the device for push-button selection is not of very much interest to the radio fan unless he can construct it himself. Here is one of the most simple push-button selectors we have seen yet.

The material necessary for building this set is a small oscillating fan motor, some bakelite or hard rubber rod 1½ inches in diameter, a pulley belt, a variable resistance, one cable of four wires, and a long two-wire cable. Remove the blades and guard from oscillating fan, disconnect wires from armature to field and solder on four long wires—two from the brushes and two from the field. Use the four screws that support guard to place motor on. Next, make a groove around oscillating gear pulley. Put motor on back of the set and adjust the belt, made of cord or spring, from the pulley to the drum of the condenser gang. Then place variable resistance in series with the line. Now take the bakelite of 1½ inches diameter and drill seven holes in it—six to secure the contacts and one hole in the center for fixing the bakelite rod to the base. Then affix a long two-wire cable to the main switch, using a pear push button to control it.



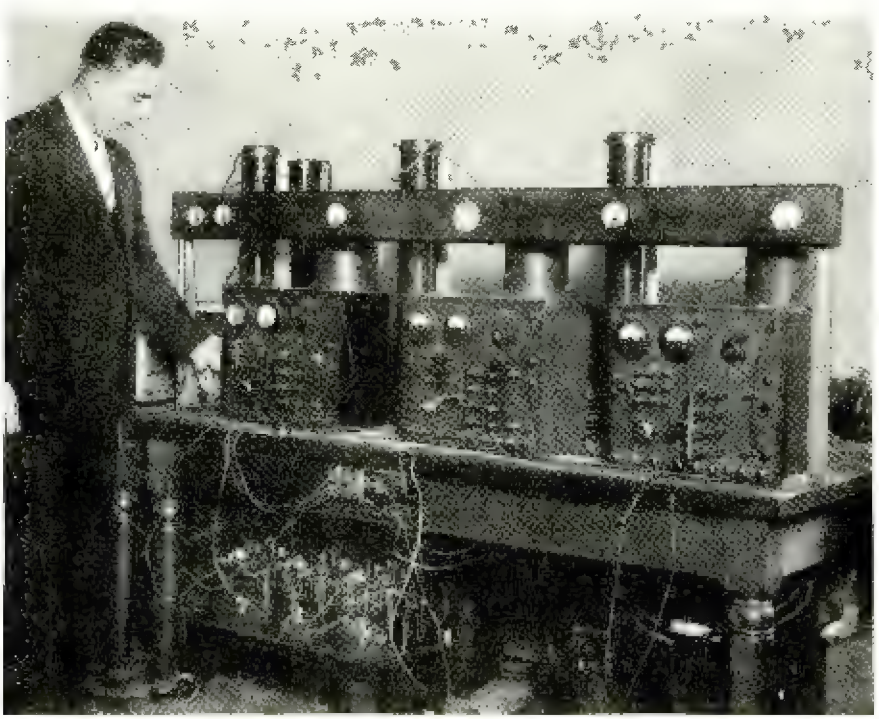


Above is diagram showing circuit of motor in series. At left is diagram showing selection switch and hook-up for circuit.

The four-wire cable should next be fixed, as shown in diagram, and led to an easy chair or any other place from which the operator desires to operate his selector.

This selector has proved very satisfactory in operation and has been practically trouble-proof. It is very simple in construction and can be made at home without any trouble. This has been hooked up on a 110-volt line; and if some resistance is not used, the motor will tend to overspeed. It is advisable in this case to use a power clarostat or its equivalent.—*Carlos Frowein.*

Now—Three Transmitters on One Aerial



©Harris and Ewing

A scene in the laboratory at Washington, D. C., where three transmitters operate on one antenna.

RECENTLY the U. S. Signal Corps radio engineers have developed an innovation in radio transmitting which is highly important and noteworthy. We all know of the unusual amount of trouble and interference caused by the neighbor's radio in the days of the old regenerative sets. This interference was due to a number of things—one of these was the aerial of the troublesome set. Now the Signal Corps experts claim to have perfected a system whereby three sets may transmit at the same time on the same aerial. Each transmitter uses a different wave-length without any interference from either of the other sets: they are shown at the left. The three transmitting sets are all lined up close together, yet there is no interference with the individual transmission of the respective messages.

The Signal Corps, under the direction of Major William Blair, is now working on a similar device for army receiving sets. One method of connecting more than one receiving set to the same antenna was illustrated and described in the November issue of this magazine.

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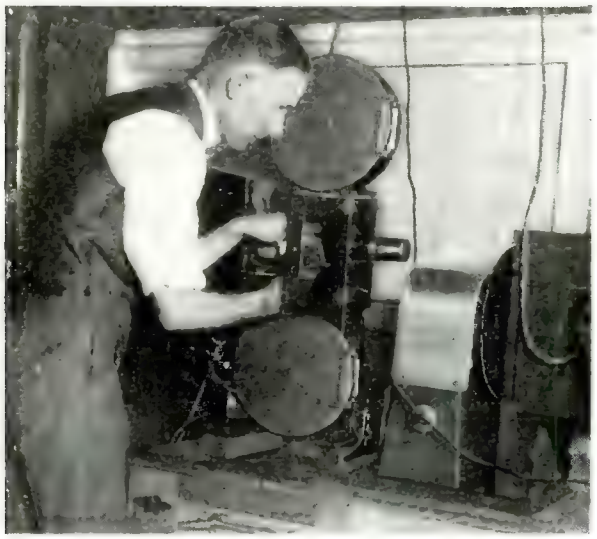
Sends "Movies" by Radio

RADIO Television amateurs are now building apparatus to transmit motion pictures as well as receive them. J. F. Brott, a radio engineer of Seattle, Washington, has designed and built his own television transmitter and receiver. With this apparatus, Mr. Brott broadcasts motion pictures, which are regularly received by his neighbors.



J. F. Brott with his amateur motion-picture broadcaster.

The Brott amateur television receiver.

The transmitter, shown at the left, consists of a motion picture projector, modulator, and light-sensitive cells. The cable going to the ceiling runs to the radio transmitting station.

The box-like affair above contains the television receiver motor, scanning disk, and neon lamp. The image forms on a plate approximately one inch square.

Portable Televisor

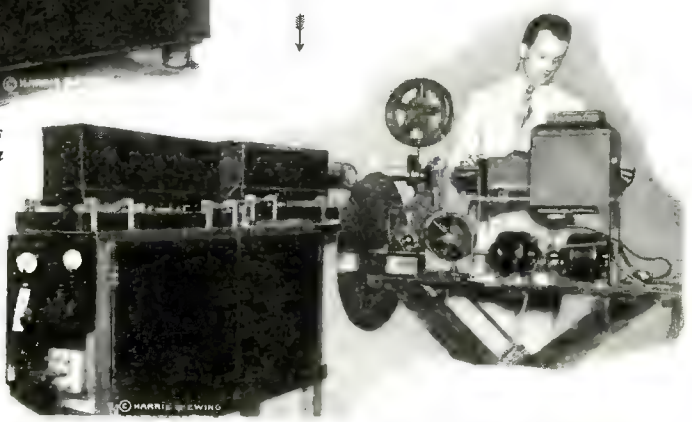
A PORTABLE outfit for taking television pictures has been invented by Dénes von Mihaly, a radio engineer of Germany. The apparatus may be used to take motion pictures and transmit them via radio to various distances. Through the medium of this apparatus it is not necessary to have a huge permanent transmitting station; pictures can be transmitted from any spot desired.

Such a development of television brings it into the realm of the news photographer. What seemed like a wild dream a short time ago is now a scientific possibility. We are now on the threshold of witnessing the latest news events at the same time that they happen. Directly we shall see athletic games and the like while they are going on.

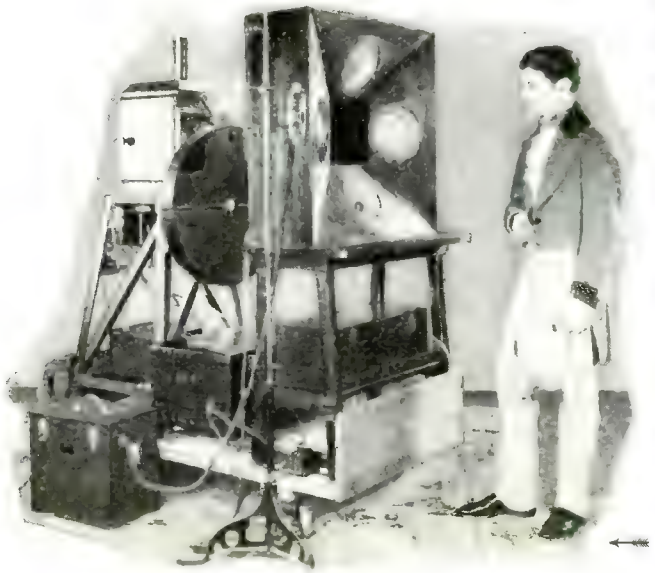
Dr. Mihaly with his portable television transmitter.

Jenkins Now Broadcasting Movies

MOTION pictures are now being broadcast nightly by short waves over a powerful radio station located ten miles outside of Washington, D. C., near Silver Springs, Md. These broadcasts are being made over the new television transmitting station of C. Francis Jenkins. This station is powerful enough to be capable of covering the Eastern United States with radio pictures.



The Jenkins motion-picture projecting machine, scanning disk and radio amplifier. The radio transmitter is located in another room.



Look In! R. C. A. Is Televising

NIGHTLY broadcasts of motion pictures and still pictures are being sent over the R. C. A. experimental station W2XBS, located in New York City. These broadcasts are made on a frequency of 2,000 kilocycles, or 142.8 to 149.9 metres. The photograph at the left shows the television transmitting apparatus. Announcements of the station's call letters and other information are sent out like movie sub-titles. A card with the information to be broadcast, printed in large letters, is held before the televisor screen. Occasional attempts are made to broadcast pictures of people directly.

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Interference Screen

A NEW screen cage for the use of dentists or other persons using electrical devices in the proximity of radio sets has been put on the market under the Tobe trade-mark. This screen cage is designed to protect electrical instruments from affecting radio receivers.

Screen Gridifier

HERE'S a really ingenious device manufactured by the Insuline Corp. of America. It's called a screen gridifier and enables any radio set owner, with a supply of 110 a.c., to enjoy the benefits of screen-grid tubes without any trouble. It is completely shielded, requires no wiring changes and will fit any standard UX four-prong and five-prong socket. With this device, the problem of using screen-grid tubes and being up to the minute is readily solved

NEW RADIO DEVICES

New Filterettes

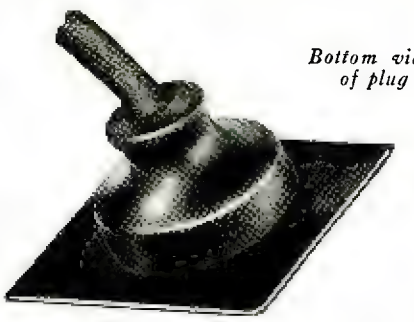
THESE filterettes are designed to act in conjunction with the screen cage shown above. The Tobe filterettes are plugged in series with the line. The manufacturers claim that the use of these two devices will eliminate all causes of electrical interference and distortion on radio sets, due to X-ray or other electrical machines in the immediate neighborhood.

The causes of distortion in a radio receiver may be due to numerous things. Here are a few ways of telling the reason for the distortion or any unusual noise in the set. A universal type motor will cause either a high-pitched whine or singing tone. A rough buzzing tone is the result of disturbance from the ignition system of an oil-burner. The electric refrigerator causes an intermittent crackle in the set, sometimes being steady and coarse for several seconds. The easiest way to eliminate these various noises is to plug a filterette into the line.

Four-Pronged Plug

THIS plug is manufactured by the National Co. and is said to have better contact points than the ordinary plug. It is of sturdy construction and the danger of breaking wires from binding posts is minimized.

It has a special thumb-shaped end; this prevents the usual wear and tear on the wire from pulling. The plug is especially adapted for connecting dynamic speakers and comes with 4 and 5 prongs.

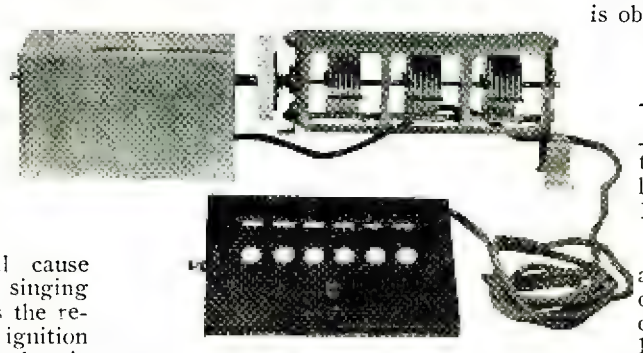


Bottom view of plug

Shows plug fitting snugly into socket.

Push-Button Selector

THE remote control device shown here is manufactured by the Motormatic Radio Appliances and works on the principle of motor operation and magnetic control. It is available for any six stations on the dial drum, and any number of remote control boards may be used. This selector is intended for standard sets and has the advantage that when the station has been tuned in, a light by the button flashes on.



Master Voltage Control

THIS is the product of the Master Engineering Co. and it is designed to prevent excess voltage reaching the set and burning out the a.c. tubes. It may be plugged into any wall or floor socket. The control has a scale of desired voltages on its side. One has merely to plug into the control and the necessary voltage is obtained.

A New Tube Speaker

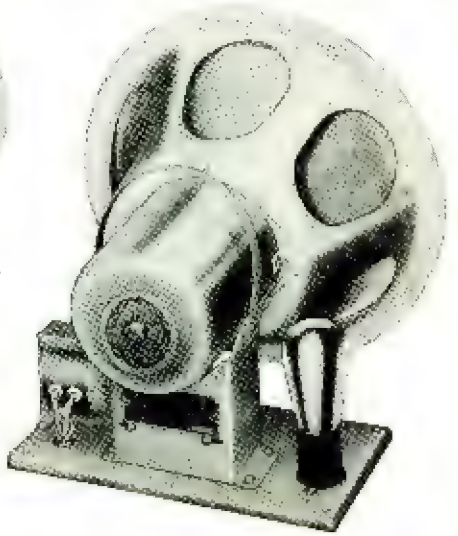
BELOW is another Oxford dynamic speaker, using a 280-tube rectifier. It is designed to handle large volume and has a 12½-inch metallized cone.

Both of the speakers shown here are designed for auditorium use; other models are available for use on home sets; both are designed for 110 a.c. operation. The unique feature in both of these speakers is the special processed metallized cloth which is used. This cloth is impervious to all atmospheric changes.

Oxford dynamic with Kuprox rectifier.

Improved Dynamic Speaker

HERE is a dynamic speaker. the product of Oxford Radio Corp., which uses a Kuprox double rectifier. The cone has metallized cloth and the speaker is designed for 110 a.c. 60-cycle circuits.



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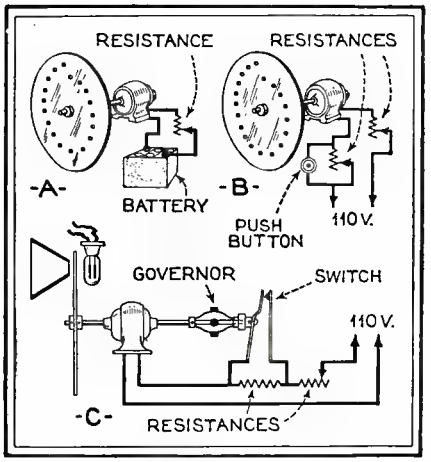
Television Speed Control

(737) Arthur Jones, Jersey City, N. J., inquires.

Q. 1. Sometime ago I saw an article giving several means of controlling television motors so that they could be easily synchronized. Will you please show the methods used?

A. 1. Several methods of keeping a television motor in synchronism are shown. The method shown in diagram A is probably the simplest and in some ways



Three ways in which to control the speed of television motors; "C" is automatic.

the most reliable. This is to use a twelve volt motor connected to a twelve volt storage battery with a controlling rheostat in series. The motor on such an arrangement will not vary in speed to any appreciable extent as the current supply from a storage battery, providing it is well charged and has sufficiently large capacity, is constant long enough to supply power for quite a series of pictures. Once the speed of the motor is adjusted, it will not vary for about one-half hour at a time.

This method is used in many television laboratories, chiefly because it is simple and reliable.

The method shown at B is for use with a motor connected to the regular lighting circuits. The current supply of such a circuit is not so constant as that from a storage battery, so that the speed of the motor will vary to a certain extent. The approximate speed is found by varying the large resistance. The resistance is then increased about one notch and the desired speed obtained by pushing the button. When the speed of the motor increases beyond the point of synchronization, the push button is released, throwing in the small resistance, which will slow the motor up to synchronization, and if it should become too slow it can easily be brought back to the proper speed by again pushing the button. This method will work satisfactorily if the line voltage is fairly constant.

The arrangement shown at C provides for automatic synchronization control. This arrangement is similar to the arrangement in B, except that the push button is replaced by the automatic switch and centrifugal governor. When the motor goes too fast the governor opens the switch, connecting the small resistance into the circuit. When the motor goes too slow, the resistance is automatically

RADIO ORACLE

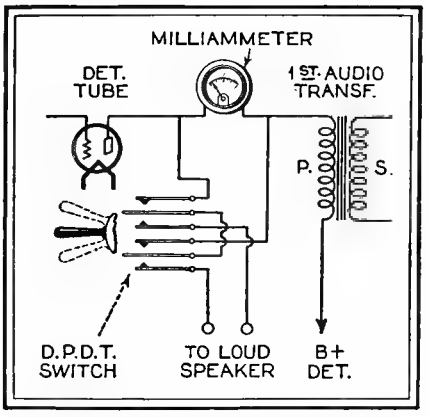
A Monthly Question and Answer Department

shunted out. This is a good arrangement but requires some manipulation before it can be made to operate smoothly and successfully; it will be necessary to do some careful experimenting with the governor and the small resistance, to find the proper size and adjustment of each.

Visual Tuning

(738) James Wailes, Freeport, Texas, writes:

Q. 1. I recently noticed an advertisement of a radio set having a so-called *tuning meter*. This was an ordinary meter on the panel of the set which showed when stations were tuned to their maximum point without depending on the loud speaker. Will you kindly show me the



How to connect a tuning meter. With switch down, meter is in circuit and speaker cut out; switch up, speaker is cut in.

wiring diagram of such an arrangement, and how it operates?

A. 1. A diagram of the automatic tuning meter is shown. When the switch is in down position, the speaker is switched out of the circuit and the milliammeter thrown in. This makes it possible to tune in a station without the usual squawks and squeaks and to a definite maximum point of resonance. This will be indicated on the meter at the highest reading.

When the switch is in up position, the milliammeter is switched out of the circuit and the loud speaker goes into operation.

Such an arrangement is a definite improvement to any radio set. It eliminates guess work in tuning, and saves wear and tear on the nerves of the people listening to the programs. The device is particularly useful where a dynamic speaker, which handles a great deal of volume, is used.

Improving the Neutrodyne

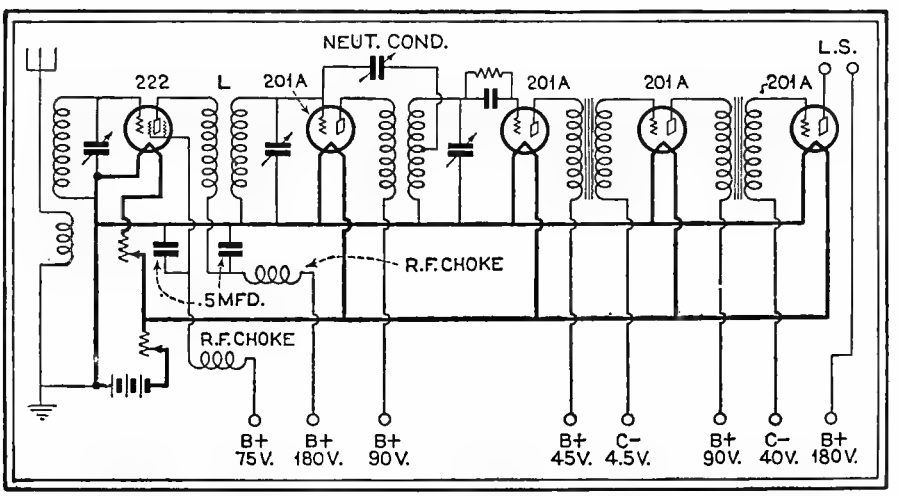
(739) Joseph Hanson, Gaston, Ill., asks:

Q. 1. I have a five-tube neutrodyne which I purchased several years ago when this type of set was considered the best obtainable. There are many sets now on the market much more sensitive than my set. However, it gives me quite satisfactory service, except that I should like to be able to improve the sensitivity. Would it be possible to convert this set to permit using screen grid tubes?

A. 1. In order to convert your set into a screen grid set, it would be necessary to rip out most of the apparatus in the set, change the coils, put everything in special shields, and incorporate a number of chokes and by-pass condensers. This would be a rather expensive proposition and in the end it would be easier to build a complete new receiver. You may improve your set, however, by adding one screen grid tube. It will only be necessary in this case to change coil "L" and add the usual choke coils and by-pass condensers. A complete diagram showing the changes necessary to add one stage of screen grid amplification to your neutrodyne is shown.

With your set rearranged in this manner it will be much more sensitive than originally.

We do not advise you to try to construct the coupler "L." This should be a standard screen grid coupler, as the regular neutrodyne transformers are not suitable for screen grid tubes.



This diagram will interest owners of neutrodynes and other sets, as it shows how to make the set more sensitive by adding a shield grid stage.

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Scientific Humor

A Monthly Fun Page for Those Who Enjoy a Laugh

ALAS, TOO TRUE

A teacher was explaining to her class the meaning of the word bigamy."

"It means having two wives at one time," she said. "Now tell me what word means having one wife?"

A boy responded—"Monotony."

—*Albert Deluca.*

SHOULD HAVE BEEN A TIME EXPOSURE

DARING PHOTOGRAPHER — I was scaling the bluff attempting to get a close-up of the cliff bird's nest, when my suspender broke.

AWED LISTENER — And then. . . .

DARING PHOTOGRAPHER — Why . . . er . . . an under exposure resulted.—*Fred E. Erdos.*

NUTTIER BY THE 2ND

1ST—That's a cuckoo clock.

2ND—Yeh, I noticed it isn't right.

Paul Kopetka.

AVIATORS—USE THIS!

AVIATOR — Wanta fly?

FLAPPER — O—oo yeth.

AVIATOR — I'll catch one for you.

—*Frank Gora.*

IN THE ROUGH

It was a hot, sultry session in the courts and the judge was thinking other than judicial thoughts. Finally the lawyer said: "He claims his wife was intractable, your Honor, so he beat her into subjection with a golf club."

"How many strokes?" asked the judge absently.

—*Mrs. H. E. Chrisman.*

THE LOBSTER TEST

First Prize— $3.00

MRS. HIGH—Now, Mary, when you bathe the baby be sure and test the water with the thermometer.

MRS. HIGH (one hour later)—Did you use the thermometer?

MARY—No, ma'am. I didn't need it. If the water's too hot, the baby turns red, and if it's too cold, she turns blue.

—*Earl Bennett.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

LET GO THAT WHEEL!

The average woman's idea of intelligent driving is to stick a hand out each side so she can turn either way she wants to.

—*Annie Richard Taylor.*

DARKENS SKINS

"Why do you leave your shoes in the sunlight?"

"I am trying to make them tan."

—*Florence Harmon.*

A PANACEA

OLD LADY TO DRUGGIST (Angrily)—Well, sir, what can you mean? You sold me this thermometer with the instruction that I should keep it under my armpit for half a minute. I kept it there for half an hour and yet I was none the better."

—*Seavax Framroze Desai.*

YEARS OF COLLEGE FOR THIS

CUSTOMER—Good heavens, Mr. Druggist, I'm poisoned! It must have been the sandwiches my wife gave me.

PHARMACIST—Yes, that's it. I tell you, you're taking a chance every time you eat a sandwich that isn't prepared by a registered pharmacist.—*Miss Ursula Greene.*

VERY ATTRACTIVE

The man with a lot of personal magnetism unfortunately walked through a hardware store.

—*Cletus Gardner.*

APPLY WITH GUN!

WIFE to Impatient Hubby—If you had a face like mine, what kind of powder would you use?

IMPATIENT HUBBY—Gunpowder.

—*Miss Shirley Clarke.*

WE'VE SUCCEEDED!

"Science and Invention reminds me of a man with poor blood."

"Why?"

"Both are trying to work up a good circulation." —*Earle Bennett.*

SCIENTY SIMON SCIENTIST

BY GEORGE!·· THAT'S A GREAT STUNT TO TRY SOMETIME, ISN'T IT JOE?
WELL DO IT WITH A LITTLE ROCK FIRST·· THAT'LL BE EASIER!
OK. SI!
SWISH!
W. LEMKIN
SCIENCE LESSON NO.37
THIS FAMOUS ROCK-SPLITTING STUNT, COMING FROM INDIA, INVOLVES NO TRICKERY, AND IS BASED ON A SOUND SCIENTIFIC PRINCIPLE. IT IS REALLY POSSIBLE TO CRACK A HEAVY BOULDER HELD AS SHOWN, WITH NO INJURY TO THE ONE HOLDING IT. THE REASON IS THAT THE GREATER INERTIA OF THE LARGE ROCK PREVENTS THE FULL SHOCK FROM BEING TRANSMITTED TO THE HEAD.. WITH A SMALL STONE THERE IS NO SUCH PROTECTION

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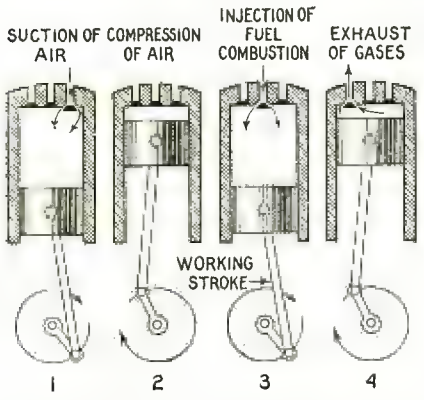
A Monthly Scientific Question and Answer Page

The Oracle

The Operation of Diesel Engines

(2334) Joseph Smith, Philadelphia, Pa., writes:

Q. 1. Will you give a simple diagram of a Diesel engine, showing how it operates?



This diagram explains the operation of the Diesel engine. Air is first sucked into the cylinder, then compressed, which causes heating, after which the oil is sprayed in, combusts, producing the power stroke, and then exhausts.

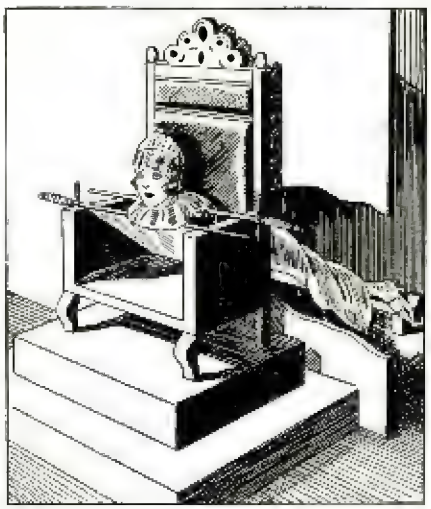
A. 1. A schematic diagram of a simple Diesel engine is shown. Its construction is similar to a gasoline engine, except that there is no spark plug and the construction is heavier to permit a higher pressure to be used. Instead of sucking in its gasoline vapor, air is sucked into the cylinder and this is compressed. When air is compressed to a great degree, as in an engine of this type, the temperature rises to a great extent. Oil is then injected into the cylinder in a spray and the heat of the compressed air ignites the oil, causing combustion and forcing the piston down, as shown in position 3. The burned gases are exhausted on the upstroke and the cycle is repeated.

Decapitated Head Illusion

(2335) Howard Petersen, Quincy, Ill., writes:

Q. 1. I remember attending a fair once and seeing an arrangement of a woman's head resting on two swords placed across the arms of a chair. The head was alive, but there was no body attached to it. The result was weird. I should like to know how this was done and whether I could produce such an illusion.

A. 1. The illusion you refer to is called the "decapitated head illusion." The head is exhibited in a curtained recess and reposes upon two swords lying across the arms of a chair. The chair is upholstered in red plush and is placed close to a curtain at the back of the recess. At the back of the chair is an opening just below the level of the tops of the chair arms. This opening is not seen from the front, as it is concealed by a mirror that is placed between the arms of the chair at an angle of 45 deg. The ends of the mirror rest in folds of the fan-shaped upholstery on the inside of the chair arms. The lower edge of the mirror rests on the bottom of the chair and the upper edge is concealed by laying one of the swords on it, as may be seen in the illustrations. At the proper angle the bottom of the chair is reflected in the mirror, giving the impression that one is looking at the back. The folds in the upholstery of the inside of the arms effectively conceal the right and left ends of the mirror. There is a hole in the red curtain, directly opposite the hole in the chair back, through which there passes a board, supported at one end by resting on the seat of the chair, and at the other end by a small box or any convenient article. The performer rests on this.



How the illusion known as the Decapitated Head is constructed. The mirror hides the body, as this diagram shows.

The "Oracle" is for the sole benefit of all scientific students. Question swill be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.

2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.

3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.

4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

Formation of Hailstones

(2336) Henry Cowan, Miami, Fla., writes:

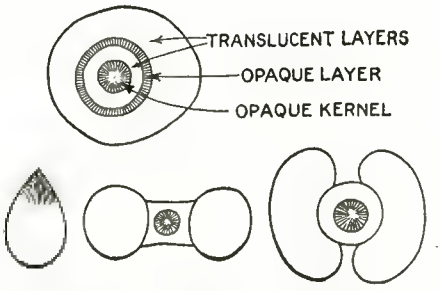
Q. 1. I should like to know how a hailstone is formed.

A. 1. Some recent scientific experiments by Dr. C. E. T. Brooks, Honorary Secretary of the Royal Meteorological Society of Great Britain, definitely explains the process of the formation of a hailstone in *Discovery:*

"It begins as a number of scattered molecules of water vapor in moist air near the ground, in the path of an advancing thunderstorm. When the air is drawn into the storm it rises, expands and is cooled by expansion until it becomes saturated. The water vapor condenses and forms drops, but these are small and are still blown upward, growing all the time. They pass into air below the freezing point and rise through a further height of five or ten thousand feet as super-cooled drops, until some of them freeze and form small particles of ice. At this level we have ice particles and super-cooled drops together and whenever an ice particle touches a super-cooled drop the latter freezes onto it. The incipient hailstone so formed, being now too heavy for the air current at that great height to sustain, begins to fall and on its downward path it meets and absorbs more of the super-cooled drops which are blown up against it. At the same time ice crystals are being deposited on it direct from the moist air and by these two processes it gradually becomes coated with a layer of opaque ice.

"On its downward path the hailstone meets with warmer and warmer drops, until it enters the level at which their temperature is just above 32 deg. F. Here it becomes coated with water which freezes more slowly and forms clearer ice. From this point the hailstone may continue its journey to the ground, arriving at a simple sphere of moderate size, consisting only of an opaque kernel and a single translucent layer; or it may be carried up again into colder levels and begin the process of formation afresh with a layer of opaque ice. Finally, however, it finds a way to the ground, either breaking through the upward current by the mere force of its weight, or else finding a way around the edge of the current to less disturbed air. It is possible that some hailstones freeze together during the formation of the outermost translucent layer, but it is hardly probable. The freezing together most likely takes place on the ground and accounts for many of the most sensational stories about hailstones ranging up to the size of a man's head, if not larger."

The diagram shows various types of hailstones, although the spherical form is the most usual.



This diagram explains various types of hailstones. The spherical shape is most common.

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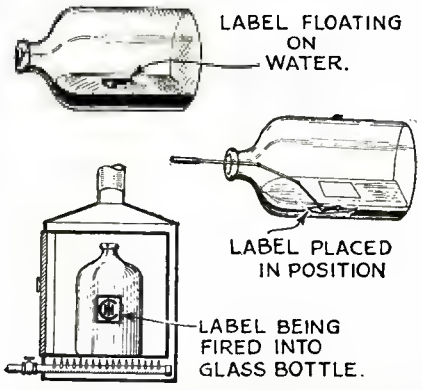
Latest Patents

Labeling Bottles

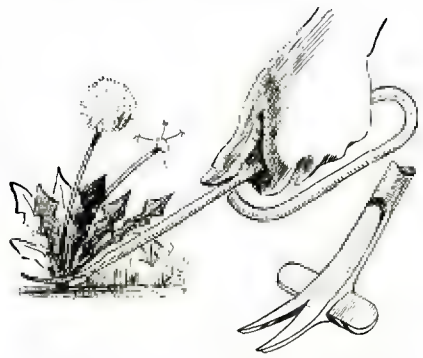


No. 1,725,199, issued to Antonius R. Kuhn and James J. Furlong. Decalcomanias when wet are easily injured. It therefore becomes difficult to place them on the inner surfaces of bottles where labels would be naturally protected. In this method the label is floated on water, and when the design is free, it is pushed down to adhere to the side of the bottle while the water is removed. After this the label is fired into the glass bottle by means of heat.

Milk-skimming Bottle

No. 1,722,396, issued to Winfield S. Reiber. With a milk bottle constructed with a division, as the illustration here shows, it is possible to separate the milk from the cream by merely tilting the bottle. For purposes of this illustration, the cream is shown being poured off in one position, but to prevent bubbling, the bottle is preferably turned around, so that opening is on top.

Dandelion Weeder

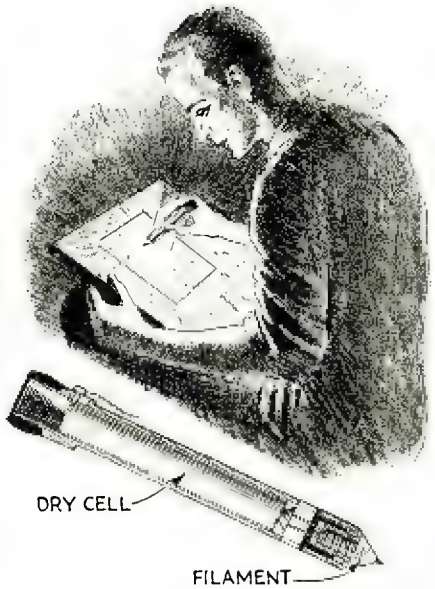


No. 1,725,191, issued to Thomas C. Holmes. This simple tool is small enough to be conveniently carried in the pocket. It has a bent handle to protect the user's knuckles and is employed for removing dandelions and similar weeds from the lawn.

Notice to Readers:

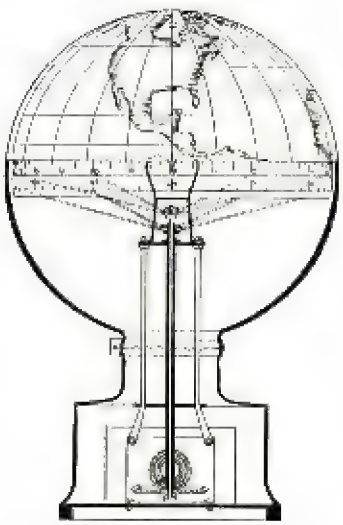
These illustrated and described devices have recently been issued patent protection but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the correct addresses of inventors of the devices to any of our readers, as the only records available are at the Patent Office at Washington, D. C., and give only the addresses of the inventors at the time of application for a patent some time ago.

Illuminated Pencil



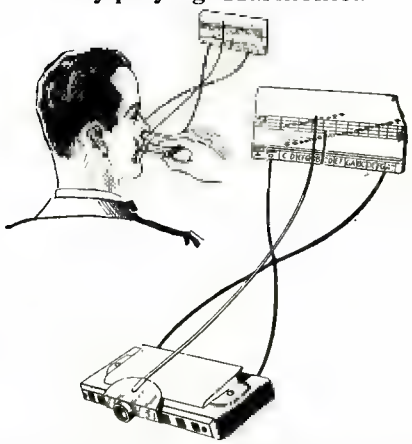
No. 1,722,238, issued to Albert Weber. The bulb containing the filament is provided with a central bore through which the lead is fed. The pencil itself contains the dry cell or battery.

World-time Clock



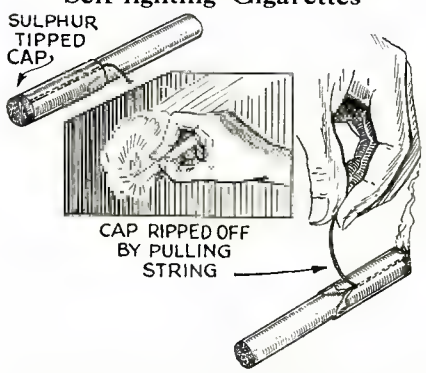
No. 1,720,902, issued to Elmer T. Isaacson. This unique clock has a stationary pointer and graduated horizontal dials which are moved by a clockwork mechanism. The time can be readily ascertained. The spherical representation of the earth's surface is associated with the clock in such a way that standard time, at any designated point on the surface, may be ascertained and the relative time at other points may be readily determined.

Easy-playing Harmonica



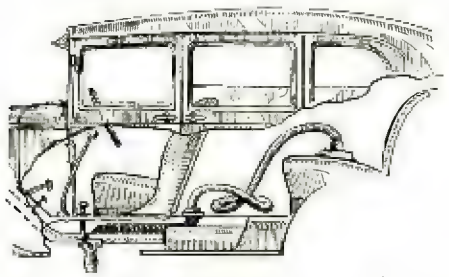
No. 1,722,852, issued to Frank Miller. By means of this attachment a harmonica may be played by amateurs in an easy and accurate manner. A bent wire rack holds the music and a slide fits over the reed openings and communicates with a piece of bent wire. By moving this slide-mouthpiece back and forth, the user can play any music arranged for the instrument. The design of the mouthpiece eliminates tonguing.

Self-lighting Cigarettes



No. 1,723,877, issued to Nicolai Mednikoff and Leo Liberthson. Attempts have been made to develop cigarettes with a striking compound on the end so that the cigarette need merely be rubbed against the side of the container to light it. Usually in striking such a cigarette against a prepared case, the paper of the cigarette is either ruptured or distorted. In this system a heavy paper wrapper surrounds the cigarette and this wrapper is removed by pulling on a string after the cigarette has been lighted.

Auto Vacuum Cleaner



No. 1,722,265, issued to Lester Filmore Beaulieu. In this invention the necessary vacuum has been obtained from the exhaust of the engine without the use of any fan or any mechanism driven by the exhaust. A simple trip in the base of the car directs the exhaust gases downward, which produces a partial vacuum in a branch passage.

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Radio Inspectors $2000 to $4500 a Year.

Radio Operators $90 to $200 a month (board free).

Broadcast Operators $1800 to $4800 a Year.

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Fill one of these BIG MONEY RADIO JOBS

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SAY "Good Bye" to long hours and low-paid work. Pick yourself a big-money job in Radio! Hundreds of men just like you earn from $2,000 to $25,000 a year in this giant world-wide industry . . . It's the livest money-making business of today!

The Whole World is Calling for Trained Radio Men

Broadcasting stations and manufacturers all over the country are eagerly seeking trained men . . . Thousands of ships require experienced operators . . . and now comes nation-wide radio telegraph service, telephony, television, photo-radiograms! . . . Thousands of opportunities like this are waiting for you.

Easy to Learn at Home With This Magnificent Laboratory Outfit

There's no need for you to know a thing about Radio. The Radio Corporation of America sponsors this marvelous, simplified home-training course . . . by means of which you, too, can now prepare for success in every phase of Radio . . . You learn by actual experience with the remarkable outlay of apparatus given with this course . . . learn how to solve every Radio problem . . . such as repairing, installing and servicing fine sets. That's why you, too, can easily have the confidence and ability to hold a big-money Radio job.

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The progress of Radio is measured by the accomplishments of the great engineers in the huge research laboratories of the Radio Corporation of America. This gigantic organization sets the standards for the entire industry . . . and sponsors every lesson in the course. That's why graduates of this school are always posted in newest up-to-the-minute developments in Radio. That's why they are always in big demand.

Money Back if Not Satisfied

This marvelous home-laboratory training practically insures your success by preparing you thoroughly in every phase of Radio manufacturing, servicing, broadcasting, photoradiograms, television and airplane radio equipment. As a student you will receive an agreement signed by the president of this school assuring you of complete satisfaction upon completion of your training—or your money will be instantly refunded.

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The young men in Radio today will be the industrial leaders of tomorrow . . . that's what happened in the automobile business . . . in aviation . . . and in every other essential industry . . . Get in on the ground floor and climb with this tremendous industry!

Free . . . everything you want to know about Radio . . . 50 fascinating pages . . . each one packed with pictures and descriptions about the brilliant opportunities in this fast-growing profession. See for yourself why R. I. A. training has placed thousands of men in well paid positions—usually from 3 to 10 days after graduation. Mail this coupon now and receive your Free Book.

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EARLE LIEDERMAN—The Muscle Builder
Author of "Muscle Building," "Science of Wrestling," "Secrets of Strength," "Here's Health," "Endurance," etc.

What Do Women Want Most?

Women want he-men for their husbands and sweethearts. None of this chorus-man stuff for the real girl. She wants to be proud of his physical make-up, proud of his figure in a bathing suit. She knows that it's the fellow that is full of pep and vitality that gets ahead in this world. He's got the physical backbone to back up the mental decisions he makes. He'll win out every time.

Look Yourself Over!

How do you shape up? Are you giving yourself a square deal? Have you got those big rolling muscles that mean health and strength inside and out? The vitality that gives you the ambition to win out at everything you start? Make that girl admire you first and foremost for a real he-man and the hardest part in winning her is over.

I Can Give It To You In 30 Days

In 30 days I can do you over so that she will hardly know you. I'll put a whole inch of solid muscle on each arm in 30 days, and two whole inches of rippling strength across your chest. I've done it for over a hundred thousand others, and I can do it for you. I don't care how weak and puny you are. I like to get them weak and puny, because it's the hopeless cases that I work with best. It gives me a lot of real joy just to see them develop and the surprised look in their eyes when they step before the mirror at the end of 30 days and see what a miracle I have worked for them.

You'll Be a He-Man From Now On!

And it's no temporary layer of muscle I put on you. It's there to stay! With those newly broadened shoulders; that perfect neck and great, manly chest, you can maintain your self-respect in any society. Every woman will know that you are what every man should be—a forceful, red-blooded he-man.

I want You For 90 Days

If at the end of 30 days you think you have improved, wait till you see yourself at the end of 90 days. Then the friends you thought were strong will seem like children by comparison. I'm not called the Muscle Builder for nothing. My system scientifically builds real muscle faster than you ever imagined.

Watch Them Turn Around

Notice how every woman prefers the fellow who carries himself with head up. Notice how the broad shouldered man always gets their eye. They want a dependable he-man when they make their choice—one who can protect them. *And you can be that man.* Remember, I not only promise it—I GUARANTEE IT.

Now don't put it off a minute. Get going to new happiness and real manhood today.

Send for my New Book *Muscular Development* 64 Pages and IT'S FREE

It contains forty-eight full-page photographs of myself and some of the many prize winning pupils I have trained. Some of these came to me as pitiful weaklings, imploring me to help them. This book will prove an impetus and a real inspiration to you. This will not obligate you at all, but for the sake of your future health and happiness do not put it off. Send today—right now before you turn this page.

EARLE LIEDERMAN
Dept. 2712 305 Broadway, New York

EARLE LIEDERMAN
Dept. 2712, 305 Broadway, New York City

Dear Sir:—Please send me, without any obligation on my part whatever, a copy of your latest book, "Muscular Development." (Please write or print plainly.)

Name..... Age.....

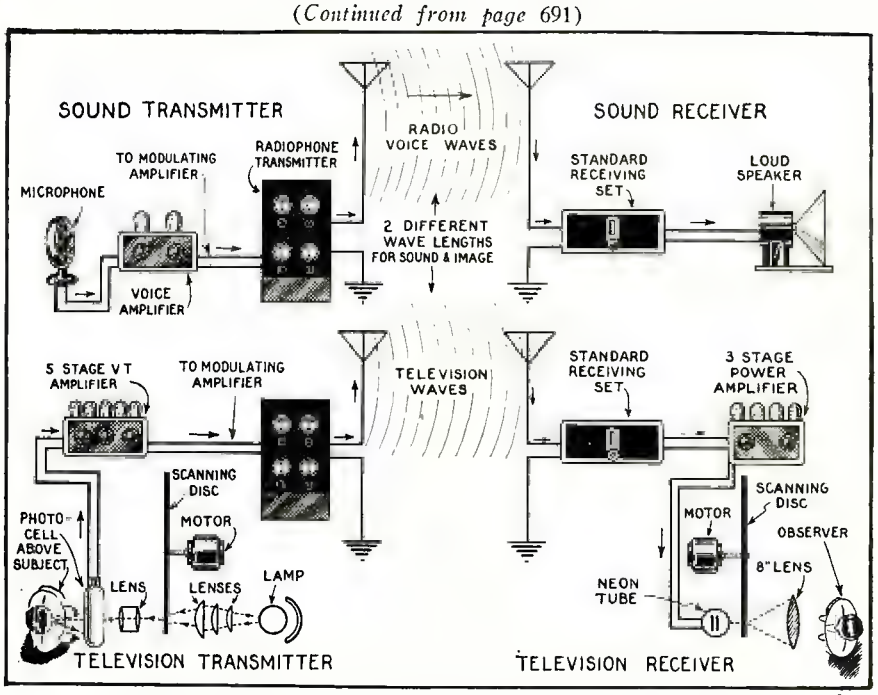
Street .....

City..... State.....

Baird's Newest Televisor

By H. Winfield Secor

(*Continued from page* 691)



The diagram above shows schematically the radio circuits for transmission of the Baird television image as well as the voice; two different wavelengths are required, one for the voice and one for the television image.

of Captain W. J. Jarrard, who represents the Baird interests in America. This newest television and tele-talkie system has a number of interesting details. To begin with, the usual carbon arc lamp is done away with and a high candle-power incandescent lamp takes its place. A scanning disc is used, provided with 30 square holes and revolved at 900 revolutions per minute. An 8-inch diameter lens is used at the receiver to magnify the image and thus give greater pleasure to the observer, the usual image on most of the television machines being about one inch square. One of the principal ideas which the Baird experts have in mind for the application of this newest development in dual television and voice transmission and reception is for the broadcasting of talking movies.

At the transmitter, a powerful source of light, such as that obtained from a 2,000 watt, 4,000 candle-power concentrated filament lamp, is condensed through a specially designed triple lens arrangement as shown in the drawing, this powerful beam of light falling on the rear of the revolving scanning disc. This transmitter disc is revolved by a 110 volt, 60 cycle a. c. motor of the synchronous type. No extra synchronizing wavelengths or circuits are necessary with this improved television system, a special self-contained sychronizing or constant-speed attachment being fitted onto the scanning disc motor at the receiving station.

As each one of the minute square holes in the whirling disc at the transmitter passes across the beam of light, it causes a small pencil of light to pass out to the second lens system and diaphragm, and thence onto the face of the person, as shown in the picture. As the pencil of light from any given hole sweeps across the face in a vertical plane, the reflected pencil of light (whose angle is constantly varying, owing to the irregularities of the face for example) falls upon the photo-electric cells.

The Light-Sensitive Cells

THESE cells in the new Baird system are large affairs, about 3 in. × 12 in., and contain a single wire electrode passing along the center of the tube, the inner surface of the tube being coated with a chemical which is sensitive to light changes in such a manner as to cause a slight electric current to be produced when light falls upon it. The secret of these cells lies in the fact that the electric currents produced are proportional to the degree of light which falls upon them; the stronger the light, the stronger the current and vice versa. The very minute photo-electric cell currents are then passed into a five-stage amplifier, of the vacuum tube resistance coupled type, and the television image or signal currents are then passed over a wire circuit to a power amplifier at the receiving instrument, as shown in the diagram. If the television image current is to be transmitted by radio waves between two stations, the image current coming from the five-stage amplifier, is passed into the modulating amplifier of a regular radio transmitter of the vacuum tube type, such as used at present for broadcasting. The fluctuating ether waves whipped off from the transmitting aerial are intercepted at the receiving aerial, from whence they pass to a suitable tuning circuit; they are then amplified sufficiently to cause fluctuations in the neon tube placed behind the scanning disc, with its spiral of whirling holes, at the receiver.

Synchronizing System

ONE of the greatest bugaboos of all television systems lies in keeping the transmitter and receiver scanning disc rotating in exact synchronism or step. If the two discs do not rotate in exact step or synchronism, the image will be distorted. Instead of using a separate circuit or an additional, separate wavelength for carrying synchronizing currents to the receiver scanning disc motor, the Baird experts have devised a simple electro-mechanical arrangement, which is fitted into a small casing right onto the receiver motor. Once the picture is framed at the receiver, the machine does not have to be adjusted again. To frame the picture, the automatic syn-

(*Continued on page* 734)

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The Man with the "Grasshopper Mind"

YOU know this man as well as you know **YOURSELF**. His mind nibbles at **EVERYTHING** and masters **NOTHING**.

At home in the evening he tunes in the radio—gets tired of it—then glances through a **MAGAZINE**—can't get interested. Finally, unable to **CONCENTRATE** on anything, he either goes to the **MOVIES** or **FALLS ASLEEP** in his chair.

At the **OFFICE** he always takes up the **EASIEST** thing first, puts it down when it gets **HARD**, and starts something else. **JUMPS** from **ONE THING TO ANOTHER** all the time!

There are thousands of these **PEOPLE WITH GRASSHOPPER MINDS** in the world. In fact they are the very people who do the world's **MOST TIRESOME TASKS**—and get but a **PITTANCE** for their work.

They do the world's **CLERICAL WORK**, and routine drudgery. Day after day, week after week, month after month, year after year—**ENDLESSLY**—they **HANG ON** to the jobs that are smallest-salaried, longest-houred, least interesting, and poorest-futured!

If **YOU** have a "grasshopper mind" you know that this is **TRUE**. And you know **WHY** it is true. Even the **BLAZING SUN** can't burn a hole in a little piece of **TISSUE PAPER** unless its rays are focussed and concentrated **ON ONE SPOT**!

A BRAIN THAT BALKS at sticking to **ONE THING FOR MORE THAN A FEW MINUTES** surely cannot be depended upon to get you anywhere in your **YEARS** of life!

The **TRAGEDY** of it all is this: you know that **RIGHT NOW** you are merely jumping **HERE AND THERE**. Yet you also know that you have **WITHIN YOU** the intelligence, the earnestness, and the ability that can take you right to the high place you want to reach in life!

What is **WRONG**? **WHAT'S** holding you back?

Just one fact—one **SCIENTIFIC** fact. That is all. And when you know what it **IS**, then you can easily learn how to apply it; make it carry you **STEADILY, POSITIVELY, AND DIRECTLY** to prosperity and independence.

That fact is one which has been **PROVEN** and stated by the world's foremost scientists and psychologists. You are only **ONE-TENTH** as successful as you **COULD** be! Why? **BECAUSE**, as Science says, you are using only **ONE-TENTH** of your real **BRAIN-POWER**!

TEN per cent of his brain is all the **AVERAGE** person uses. He is paid for **ONE-TENTH** of what he really possesses because that is all he actually **USES**. The remainder lies dormant. The longer it is unused, the harder it becomes to use it. For the mind is like a muscle. It grows in power through exercise and use. It weakens and deteriorates with idleness.

What can you **DO** about it? That is the question you are asking yourself. Here is a suggestion.

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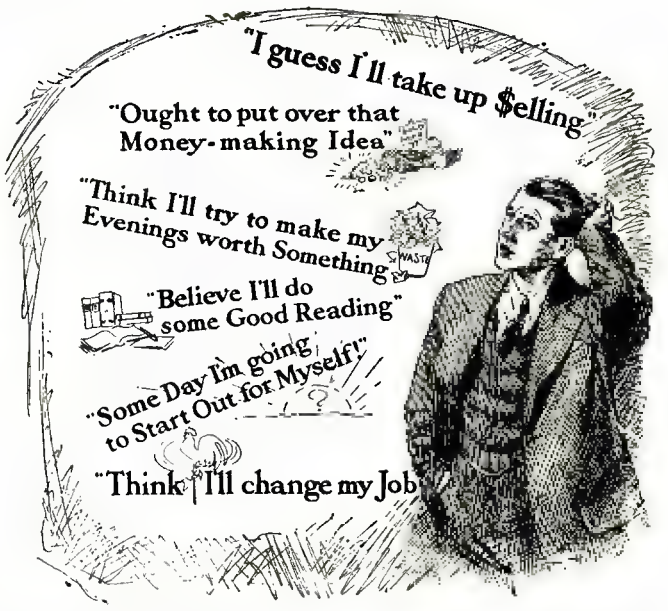
"I guess I'll take up $elling"
"Ought to put over that Money-making Idea"
"Think I'll try to make my Evenings worth Something"
"Believe I'll do some Good Reading"
"Some Day I'm going to Start Out for Myself!"
"Think I'll change my Job"

your brain an instrument of all-around **POWER**. It tells you how to banish the negative qualities like forgetfulness, brain fag, inertia, indecision, self-consciousness, lack of ideas, mind wandering, lack of system, procrastination, timidity.

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You have only **TWO CENTS** to lose by writing for your copy. You may **GAIN** thousands of dollars, peace of mind, happiness, independence!

Thousands who read this announcement will **DO NOTHING** about it. The effort and the will needed to send for this book—which is **FREE**—may be lacking. How can these people **EVER** gain what they hope for, crave for? They are the skeptics, the doubters, the "show me" wiseacres.

Other thousands will say, "I can lose only **TWO CENTS**. I may **GAIN** a great deal by reading 'Scientific Mind Training.' I will send for it **NOW**. It promises too much for me to **RISK MISSING**."

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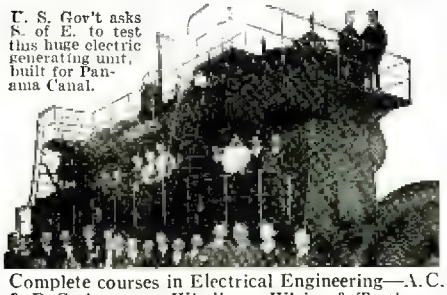
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Baird's Newest Televisor

(*Continued from page 732*)

chronizing device is disconnected for a fraction of a minute and then connected again. This is the same method as that used in synchronizing two alternating current dynamos, where no automatic synchronizing switches are used. The motor which revolves the scanning disc at the receiver in this newest system is a 12-volt d. c. machine, operated from a storage battery. It is well to mention in passing, that in many television laboratory experiments a motor of this type is used, operating from storage batteries, as it will maintain constant speed for a considerable length of time; corrections in speed being effected by means of a simple rheostat or variable resistance connected in series with the motor.

The reconstructed image of the person sitting before the television transmitter is built up by means of the whirling disc and its spiral of square holes mounted in front of the neon tube, and in this case the usual *postage-stamp* size image is enlarged many times, thanks to the use of an eight-inch lens.

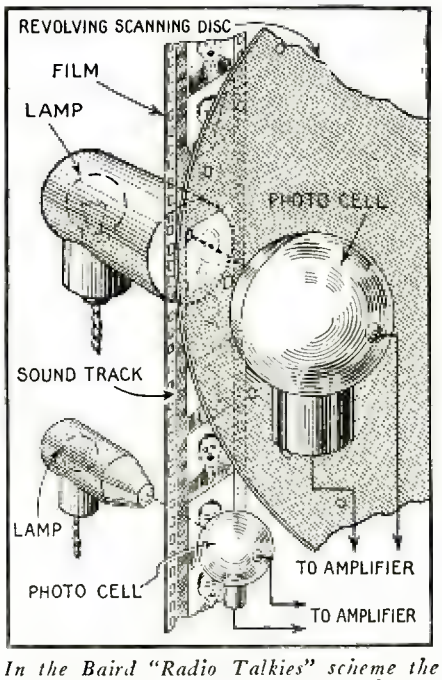
How Voice is Transmitted

WHERE the voice is to be transmitted simultaneously with the television or motion picture image, a studio type microphone is employed in the manner shown in the large illustration. The fluctuating voice currents coming from the microphone, are passed through a voice amplifier at the transmitting station, and they are then passed over a two-wire metallic circuit to a power amplifier, and thence into a dynamic or any other loud speaker desired. Where the voice is to be transmitted by radio, it requires a separate wavelength and the voice currents, as they emerge from the voice amplifier, are passed into the modulating vacuum tube amplifier of the radio transmitting set. The voice is then carried by ether waves to the receiving aerial, where it is tuned in by the standard radio receiving set, and it may then be caused to reproduce the voice by means of the usual loud speaker.

To those uninitiated in the operation of television in general, it might be mentioned that with a 30 hole disc, each hole scans 1/30th of the image, which is made clear by looking at the small lined picture in the large illustration on the title page. Thus when the 30th hole has finally passed across the light beam and caused its ray of light to traverse the image, the entire image has been scanned or explored. It will be clear from the foregoing, that if we have a second revolving disc containing exactly the same number of holes placed in a spiral, placed before the neon tube at the receiver, at any given instant we will see a spot of light on the receiving lens, of corresponding strength to that received by the photo-electric cell at the transmitter. It is up to the television engineer then to cause his scanning light pencil at the transmitter to pass over the image so rapidly, that the eye at the receiver will not notice that such a step-by-step scanning process is going on. At the present time this effect is noticeable to quite a degree, principally for the reason that the image at the receiver seems to be built up of parallel light bands. It is the hope of television experts that they will be able to overcome this and produce a practically perfect image at the receiver.

Talking Movies by Radio Promised

EFFORTS have recently been made to experimentally transmit talking films by television. One modern form of talking movies consists of an ordinary film, having printed along one side a ladder-like band of light and shade, representing the sound. This ladder-like band, as the film is projected, passes in front of a narrow ray of light, which is transmitted through the varying densities, and falls upon a photo-electric cell, setting up in the photo-electric cell an undulating electric current, which, after amplification operates a loud speaker, and reproduces the sound accompanying the visual projection of the film. In adapting this to television the visual effects are transmitted in the ordinary television manner—that is to say, by scanning the image at the transmitting end by means of a disc, perforated with a spiral series of holes; and at the receiving station using a similar disc, in conjunction with a neon lamp, to reconstruct the image. The sound effects are simply picked up from the marginal record on the film in the



In the Baird "Radio Talkies" scheme the disc scans the image where the film is stopped "intermittently," the picture image currents being picked up by the photo-electric cell and amplified. The second photo-electric cell picks up the fluctuations of the voice from the sound track on the film, through the medium of a light beam at a point where the film is traveling "continuously."

usual way, by means of a photo-electric cell, as used in the standard talking picture practice, and these sounds are broadcast simultaneously with the film picture image.

Tele-talkies as Baird calls them are sent out in a manner very similar to the transmission of television, and are received on the identical machine which receives television images. The standard films are used, but naturally subjects must be chosen suitable for transmission by television, such, for example, as head and shoulder representations. As in television, larger scenes, such a boxing matches, can be sent, but such transmissions are lacking in detail. The frequency band at present available for television is 9 kilocycles, which sets a limit to the amount of detail which can be transmitted, but as the art progresses there can be no doubt that larger wave bands will be set aside, and images of larger scope will be transmitted.

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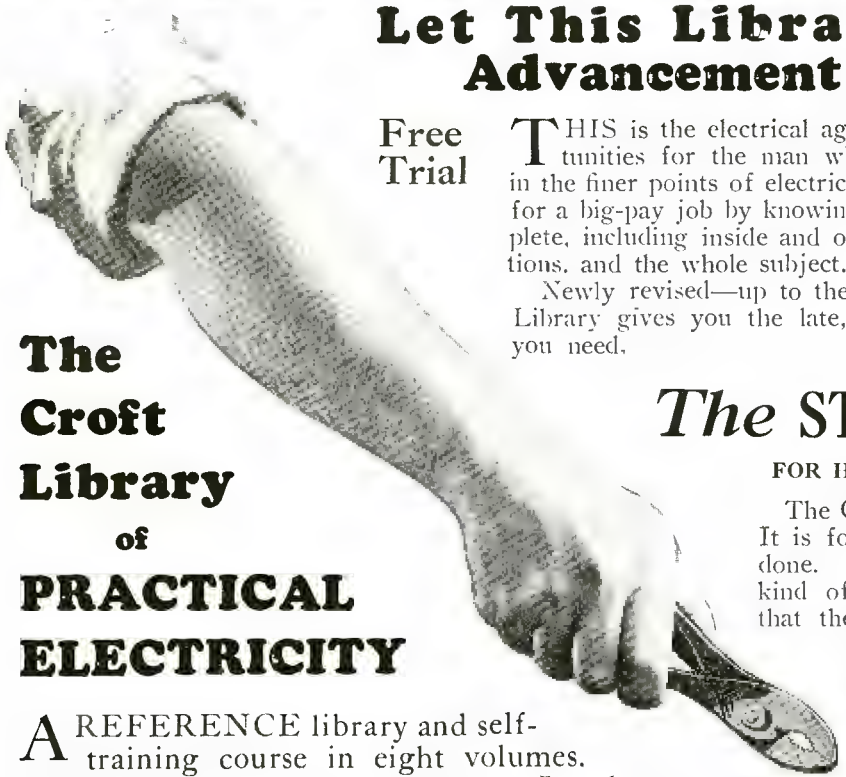

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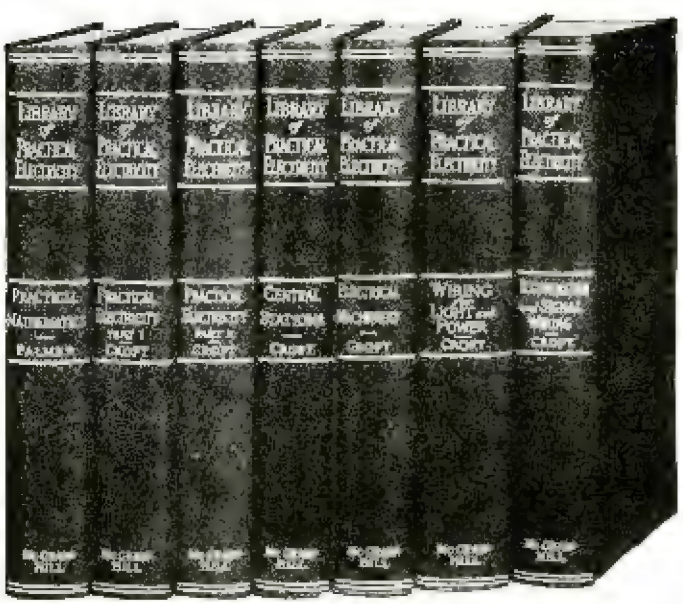

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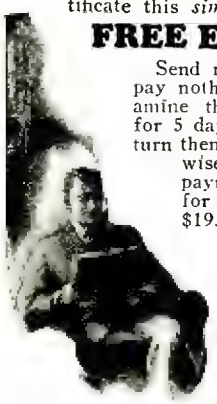

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Mansions of Mud

By A. Hyatt Verrill

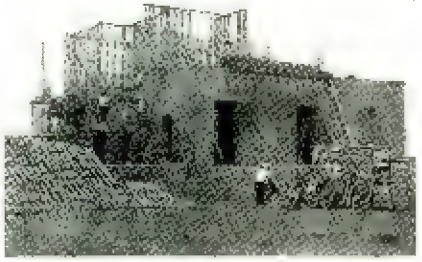
(*Continued from page* 686)

Very ancient building constructed of adobe.

the largest adobe building in the world.

For nearly five centuries adobe buildings were made in the same old way, exactly as they had been made by the Indians for thousands of years, but with the demands for modern dwellings and buildings the progressive Peruvians developed an entirely new method of mud-building construction, and today practically all the edifices made of this material are of reinforced adobe. Instead of erecting immense, thick walls of adobe bricks, the modern structure has a framework of light wood covered with a lathing of cane, metal lathes, wire-netting or light steel as a foundation for the mud bricks. By this method large, high and elaborate adobe buildings are erected, and when the outer surfaces have been covered with a stucco of plaster or a coating of sprayed cement, and have been painted and finished with ornamental plaster work, no one would dream that they were of adobe.

Such, for an example, is the magnificent Rimac apartment building which may aptly be called a "mud-flat" with its beautifully finished interior, its passenger elevators,



The new style adobe construction involves the use of a wooden frame, with the adobe blocks built around it.

and every up-to-date convenience. Palatial homes and mansions, office buildings, bungalows and Moorish palaces are all built of reinforced adobe, which in and about Lima still holds its own in competition with concrete, and one ambitious citizen even erected a medieval castle of mud.

Not only is adobe admirably adapted to Peru's climate; but it is the cheapest and the most abundant of building materials. One has only to mix some water with the soil, and presto! Your house lot becomes the source of material for building a house. But as a rule only the smaller houses are built from the mud on their own grounds. The adobe-brick industry is a very important one, and everywhere about Lima are endless walls of the brown adobe bricks ready for use as occasion demands. And when a house is to be built the workmen move bag and baggage onto the property along with the mud bricks. A niche in the pile of adobes serves as their temporary home, and there they dwell together with their wives and innumerable children like modern cave-dwellers, until the last brick has been used and they move on to the next building-site. Sun, wind, time have little or no effect upon adobe buildings, and they will stand through an earthquake that will crumble and shatter concrete or even wooden houses. But rain is fatal to them. Ordinarily real rain is so rare on the coastal area of Peru that it may be said to be rainless. During the winter there is a misty drizzle, but occasionally heavy showers descend, and woe to the adobe buildings that are not prepared for the phenomenon. A few days of really hard rain would result in a large portion of Lima being reduced to its original mud, as was the case at Trujillo when, three years ago, a series of unprecedented rains fell

Preparing the adobe blocks.

on that city. Scores of houses and buildings, that had stood unaltered since the days of Pizarro, melted and crumbled to shapeless piles of mud, while scores more became unsafe and were abandoned. But the catastrophe proved a blessing in disguise. It was found that in nearly every case the damage was caused, not by the mud walls dissolving, but by the water spattering from the ground and striking the walls at their bases and thus undermining them. To prevent this a thin coating of cement is now superimposed on the walls of all adobe buildings. This reaches from the ground or a few inches beneath the surface to a height of several feet and effectively protects the soluble adobe from the spattering of any rain.

Truly, the Peruvians may be said to have *glorified mud!*

What happens when a heavy rain strikes an unprotected adobe building.

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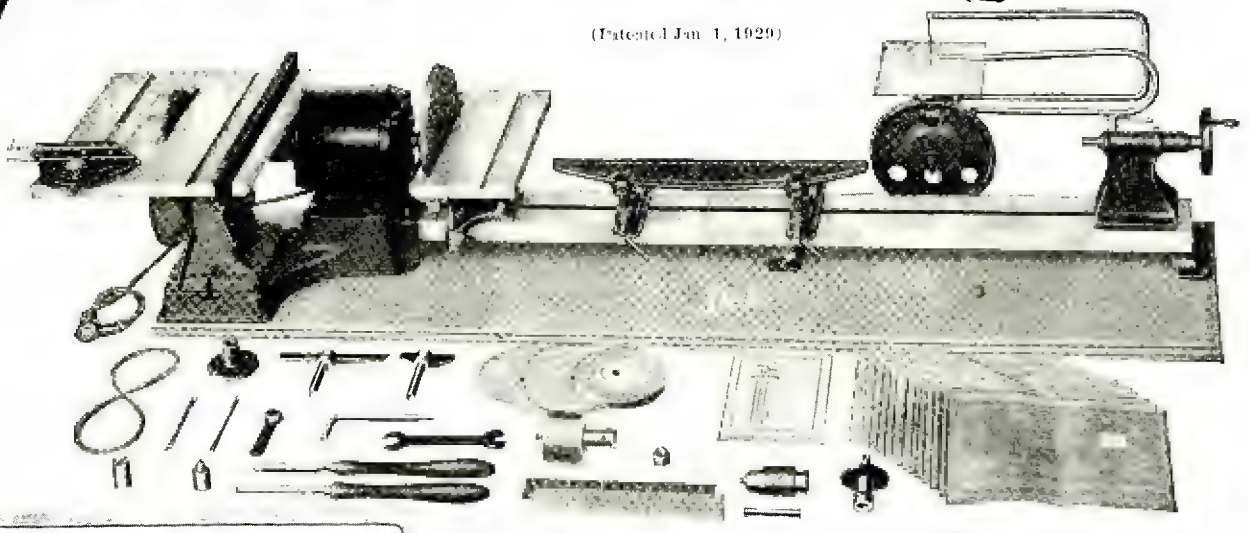

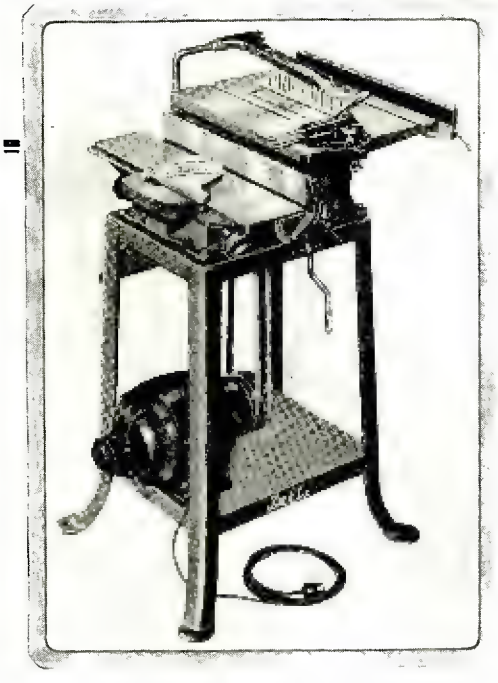

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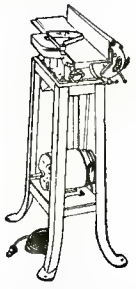

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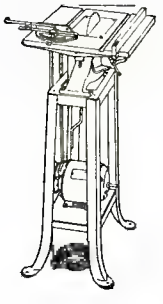

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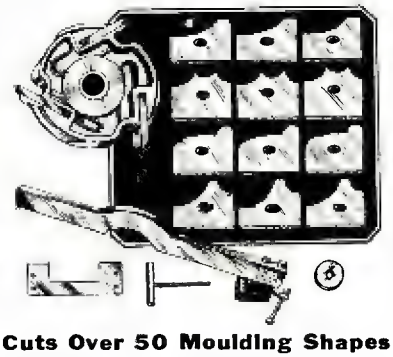

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2500 Feet Under the Sea

By H. E. Serner

(*Continued from page* 685)

and many suggestions poured in on him.

Prof. Maiuri, Director of the National Museum and of the excavation at Pompeii told Dr. Hartman that divers had seen near the Island of Rhodes, gold-glittering remnants of the fallen "Colossus of Rhodes," one of the seven wonders of antiquity, but at a depth which they cannot reach in ordinary diving suits; and he suggested that Dr. Hartman should not miss this wonderful opportunity during his next expedition to investigate and eventually recover so great a treasure.

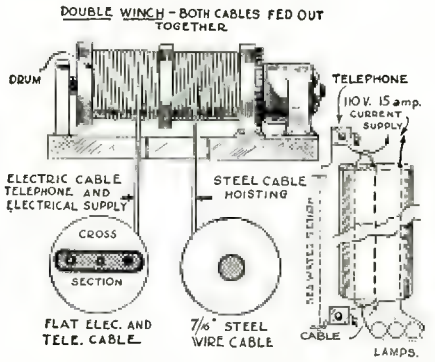
The Mediterranean, the sea of the ancient world, has a strong appeal, and Dr. Hartman believes that civilization was born upon its now water-flooded bottom, when it still was a fertile, semi-tropical valley, contrasting beautifully with the dreary steppes which then covered Central Europe. The Mediterranean, being a sea of intense evaporation, receiving little water through streams and rivers, was separated from the Atlantic Ocean by a natural, rocky dam which stretched across the Strait of Gibraltar from Africa to Spain. The deep, warm valley probably contained two lakes, separated by higher land between Italy and Tunisia, both lakes being connected by a narrow channel as can be judged from soundings. Thus the fertile, semi-tropical valley presented the best conditions for human development. We find all ancient Western cultures around it. To the North the Neanderthal men roamed the bleak and cold steppes, while most of the Northern hemisphere was buried under hundreds of feet of ice; it was towards the end of the last glacial epoch.

Then a great change occurred. The world-wide glaciers slowly melted, and the level of the oceans rose. The Atlantic began to spill over that low, rocky barrier at Gibraltar and finally broke it down, rushing its icy water in a terrific torrent into that beautiful, inhabited valley! This was probably the mightiest catastrophe which ever befell mankind. Was it the flood of the Bible? All ancient people around the Mediterranean preserved an old tradition telling of a tremendous, destructive flood, which happened in some prehistoric time. Only those inhabitants who were able to escape to the adjoining continents and to highest points, which remained as islands above the water, saved their lives. It was at about that time when the civilized Cro-Magnon race appeared in Southern Europe and Northern Africa and eliminated slowly the Neanderthalers, who may have roamed in Europe for hundreds of thousands of years without any sign of progress.

The island of Malta bears innumerable mysterious, prehistoric cart-tracks which lately were photographed from airplanes and described by Prof. Zammit, the Director of the Museum at Malta in *Antiquity* March 1928 (London). They are worn so deep into the rocky ground, that they must have carried heavy loads perhaps for hundreds of years which were drawn by humans. It remains a matter for speculation to assume that a great population, marooned by the flood upon Malta, was struggling for a miserable, pitiable existence by dragging soil and water upon the high rocky flats, being unable to construct vessels to cross the suddenly formed Mediterranean Sea. Thus the place offers the most amazing and interesting field for submarine investigation and salvage work.

During his expedition Dr. Hartman found that additional improvements were required. A dangerous ballast weight, which could be released from the diving chamber in case of emergency, had to be eliminated. Better submarine illuminators had to be constructed, and the apparatus had to be designed large enough to hold two persons. After four additional years of labor, and after spending the last winter on the Mediterranean to make further tests, Dr. Hartman has now perfected a deep sea diving chamber, wherein all the above changes and improvements have been incorporated, and which will be used for a new extensive investigation of the Mediterranean during the next spring and summer.

His new apparatus retains its buoyancy at all times, and can sink without additional weight or ballast. This had been declared by experts as impossible. Nothing can sink which is lighter than the water it displaces. Dr. Hartman however solved this problem in a most simple and ingenious way, by attaching to his diving chamber a small, electrically driven propeller, mounted on a vertical shaft, the propeller *pulling* the diving chamber down. Should the thin rubber covered cable break, through which current is sent down from a ship above, the propeller will stop and the entire apparatus will automatically



The diagram above shows the general arrangement of the flat telephone and electric light cable and also the 7/16ths inch steel wire cables, which were reeled out together in lowering the sub-sea diving bell.

rise to the surface by its own buoyancy. However as its speed would accelerate too fast, a battery can be used to operate the propeller, thereby slowing the speed down. In fact by means of this battery the diving chamber can operate below the water without any cable connection.

There remained the danger that, if a cable is used, which also provides telephone communication, it might break high above the diving apparatus, turning it upside down by its weight, and holding it down. Dr. Hartman invented a special connector, consisting of two iron shells, placed upon each other, forming an electromagnetic, egg-shaped connection, both halves being held together by magnetic force as long as an electric current passes through the cable. Should the line break the two halves fall apart and free the diving chamber from the weight of the cable. The new submarine illuminators consist of electric, luminous tubes, which are encased in strong outer glass tubes to withstand the great water pressure, and while only two are attached to the diving chamber, others can be lowered separately over any objects to be photographed. The men in the diving chamber direct the

(*Continued on page* 740)

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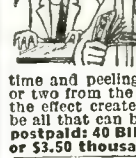
MAGIC NOSE FLUTE



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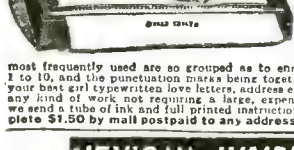

A perfect little typewriter for $1.50. There are thousands of persons who would like to use a typewriter but whose needs and business do not warrant the expense attached to the purchase and use of a fifty or seventy-five dollar machine. To such persons we confidently recommend our Little Giant. It is strongly made, but simple in construction, so that anyone can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used are so grouped as to enable one to write rapidly, the numerals 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewritten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large, expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. **Price complete $1.50 by mail postpaid to any address in the world.**

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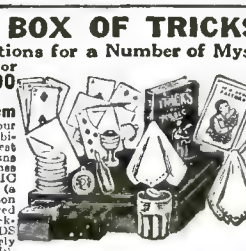

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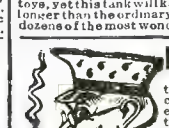
Most remarkable toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down it will crawl along, overcoming all obstacles, in the same life-like manner as the larger Tank that proved so deadly in the great war. What makes the toy somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys, yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts. **25c prepaid.**

2¼ inches long

ITCHING Powder



This is another good practical joke; the intense discomfiture of the victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more. **10c box, 3 boxes for 25c or 75c per dozen.** Shipped by Express.
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Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room at the time will begin to sneeze without knowing the reason why. It is most amazing to hear their remarks, as they never suspect the real source, but think they have caught it one from another. Between the laughing and sneezing you yourself will be having the time of your life. For *parties, political meetings, car rides,* or any place at all where there is a gathering of people, it is the *greatest joke out.* **Price 10c, 3 for 25c, 75c per dozen.** Shipped by Express.
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Lots of harmless fun and amusement were had at the times of your life. For *parties, political meetings, car rides,* or any place at all where there is a gathering of people, it is the *greatest joke out.* **Price 10c, 3 for 25c, 75c per dozen.** Shipped by Express.
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Rubber Chewing Gum

It is just like a regular package of chewing gum and looks so real that it fools everybody. And no one of course suspects it is not genuine until they start to chew it. There's a world of fun in this rubber chewing gum. 5 sticks to the package. **Price 10c Package; 3 for 25c; 12 for 75c, Postpaid. Stamps taken.**

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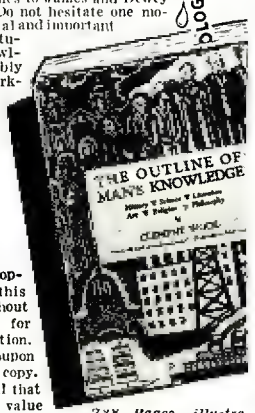

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2500 Feet Under the Sea

(*Continued from page* 738)

lowering and placing of these lights by telephone, so that only the desired objects are strongly illuminated, while the water between them and the camera remains comparatively dark. Thus a sharp photograph results at longer distance in clear waters, because otherwise, due to intense diffusion, the reflection upon the sensitized film is too strong, and the pictures would be blurred.

How Air Is Purified

THE film camera, especially built to take little space, can be operated by hand or electric motor, and take *still* as well as *moving pictures*. The air within the diving chamber is automatically supplied with oxygen from several cylinders of compressed gas, and the exhaled carbon dioxide is absorbed chemically in the lowest compartment, into which it is drawn by a small electric exhaust fan. This insures constant purification of all the air within the chamber. There is also a tubular electric heater below the seat, as the water in great depths is icy cold. A specially constructed pressure gauge indicates the depth. The diving chamber is provided with three external, vertical fins, to reduce rotation around the vertical axis, which is caused by the action of the propeller. Two propellers, turning in opposite direction, similar to those used on torpedoes, would eliminate such rotation; however, rotation at a very low speed is desired. Therefore a second propeller has not been found advisable.

The large port-hole which permits observation of the surroundings is closed watertight by a heavy quartz lens and special gaskets as also the opening for the camera below. The cable disconnecting device is arranged directly above the top of the chamber. This top is hermetically sealed by a cover which the pressure of the water tends to hold in place still more firmly. The propeller, if its action is reversed, can exert a strong lifting instead of downward pulling force. Dr. Hartman has developed new salvaging devices, based on this principle; they consist of a globular shell containing powerful electric motors, driving two vertically mounted propellers. The apparatus is further provided with gripping means, capable of lifting large objects to bring them to the surface. The operation of those salvaging devices is directed by telephone from the diving chamber. The device may be used too for salvaging purposes in a limited way, as a gripping device can be attached to its lower end for handling smaller objects.

Dr. Hartman is now forming the first *Deep Sea Research Society* and hopes to be able to conduct scientific investigations every year in the Mediterranean, and to inaugurate with his submarine diving and salvaging apparatus a new era in real deep sea research, photography, archeology, and salvage and to bring to light sunken antique as well as more modern treasures, piercing the mystery of life at the bottom of the sea. If his ambitious plans mature, many surprising disclosures of the secrets of the ocean depths can be expected. One of the first objects to be explored and photographed is a sunken prehistoric city discovered by Dr. Hartman between Sicily and Tunisia, at a depth of about 360 feet. Its location, as shown on the small map, was ideal for a large ancient settlement, as there converged the cross-roads from Africa to Europe, and from the Western to the Eastern lake, and both existed before the Atlantic flooded the Mediterranean valley. And it remains open to speculation if this great sunken city is not the "Lost Atlantis" which Plato places as "beyond the pillars of Hercules" which may have marked the entrance to that waterway leading from the Eastern into the Western lake, and not the Strait of Gibraltar, which did not exist before that mighty catastrophe which transformed an ancient paradise into the Mediterranean Sea, as we know it today. Do the rolling blue waves of the Mediterranean hold the secret of the legendary "Atlantis"?

$250.00 in Cash and Additional Prizes

Did you send in your solution of DUNNINGER'S AMAZING BUZZ-SAW ILLUSION?

If not, see September issue of this magazine. Contest closes Nov. 21, 1929. Address your solution to Joseph Dunninger, care Science & Invention.

What Our Readers Think

(*Continued from page* 723)

S. and I. in Classroom

I like your simplified explanation of the fourth dimension and relativity. I use these articles in my physics classes. I cut out good articles and put them in folders and give them out for special reports. I would like to see articles put on consecutive pages so that they could more easily be put in folders for permanent filing. The short articles are not of much value to me as they do not tell enough to give us any definite knowledge. I would like to see more completely explained articles and less short subjects.

MARTIN L. RYERSON,
Science Teacher,
Roseville High School,
Roseville, Mich.

(Many colleges, high schools and even public schools are daily using magazines more and more for teaching science to their classrooms. We would like to hear from more of our readers on the subject of "Short vs. Long Articles."—EDITOR.)

Beg Pardon

Editor, SCIENCE AND INVENTION:

Please let me call your attention to a slight error in the October issue. You had four of my shorts in, but I note you credited one to Mr. L. B. Robbins.

It makes no difference to me whether my name or a credit line is given or not, as I am not a professional writer and am not after a name or reputation in the least. However, you know a fellow does not like to see a "Short" meeting editorial approval, and credited to someone else.

FRANK BENTLEY,
Missouri Valley, Iowa.

(We are glad to list this correction in these columns. The story mentioned in Mr. Bentley's article was titled "Match Box Used As Measuring Tool."—EDITOR.)

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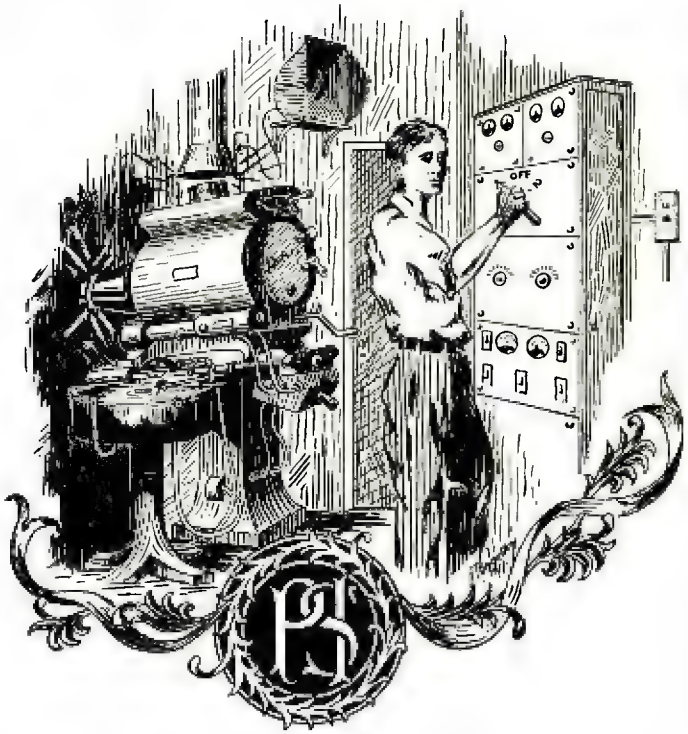

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CONDUCTED BY JOSEPH H. KRAUS

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Motor-Driven Tooth Brush

(1196) George N. Buntin, Hermitage, Tenn., writes:—

Do you think it would be advisable to get a patent on a motor driven rotary tooth brush which can be operated from a light socket? A small light waterproof motor will be located in the handle of the brush. A rheostat switch combination operated by the thumb would regulate the speed and the brush itself could be easily

A motor-driven rotary tooth brush represents a good patentable idea.

removed so as to allow several persons to use the motor with their individual bristles.

A.—If you will refer back to your filed copies of SCIENCE AND INVENTION Magazine you will find that such an article has already been devised and has been exhibited on the market. We unfortunately have no record of the organization that was exploiting this suggestion, and consequently cannot give you their address.

We might suggest that you have a search made of the patent office records to determine whether or not this idea has been fully covered and also to what extent you can protect the issue. It is doubtful that a broad and basic patent would be allowed on such a suggestion.

Combination Motor and Iron

(1197) Mrs. T. C. Tucker, of Tampa, Fla., asks:—

Should I patent an idea of a combination sewing machine motor and electric iron. This is to be used in large ready-to-wear factories in their pressing room.

A.—We do not see how a combination of this nature could produce any results and would suggest that you send a further detailed description thereof and that you mention the exact purpose of the invention. The advantages of such an idea should be pointed out for a specific reply.

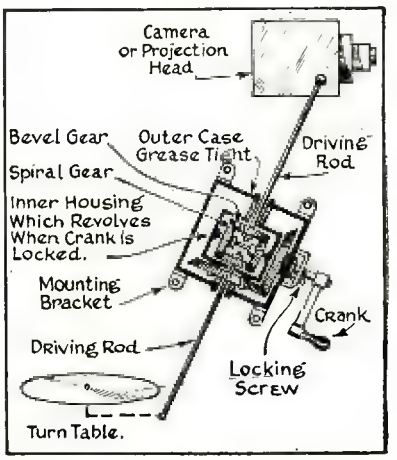
Talking Movies

(1198) Mr. W. M. Coates, of Meade, Kansas, writes:—

I have an idea for coupling a phonograph turntable to a motion picture camera. There is a drive shaft from the camera (or projector) of any suitable length which terminates in a small gear box. This shaft has a bevel gear which engages two differential gears in an inner housing, which in turn engage the bevel gear of another shaft which drives the turntable carrying the record. This inner case also has a gear encircling it, which in turn engages a pinion on a short shaft which projects from the case and has a small crank on its outer end and a lock ring, locking any position. In operation the driving rod drives the turn table through these differential gears at the same speed only in opposite directions. If the crank is turned by hand the driven shaft will slow down or speed up as the operator desires.

A.—Practically all cameras that are used for taking commercial photographs are now equipped with electrical motors, which operate both the camera and the turntable synchronously. In this way the recording laboratory can be very remote from the place where the photographs are taken. The only connection between the two points need be a pair of wires which can, if desired, be an ordinary telephone circuit.

Even in small home movie projectors a motor drive is employed and gear boxes have already been devised which will connect the projector with a turn table so that the two can be used simultaneously. We do not see anything odd or unusual in this design and cannot recommend further procedure.



Method of driving record turntable and movie camera by gears for taking "talkies."

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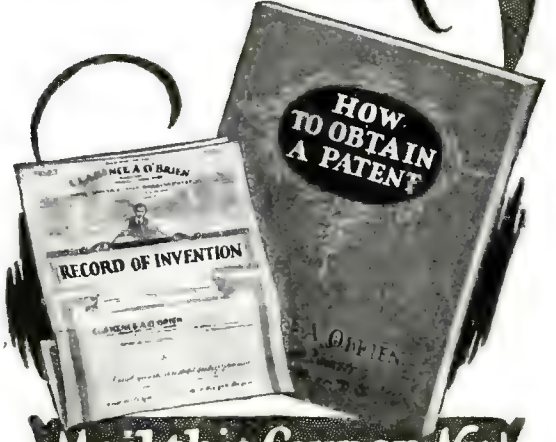

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Personal Service

What Oil Heat Offers

By Harry F. Tapp

(*Continued from page 707*)

your wife doesn't make her own clothes and your maid doesn't sleep in, you still should be interested in the effect that planning a house with an oil burner, or installing a house with an oil burner, or on the real estate value of your property. It is a well known fact that the real estate value of a house increases in proportion to its improvements and a good oil burner is a very tangible asset. How many people have you heard remark that the main reason they prefer an apartment to a house is to avoid playing nursemaid to a furnace? Such a person can soon be convinced that home owning may be accomplished painlessly and pleasantly if he buys a house that includes an oil burner.

If the man of the house is away from home frequently, his wife doesn't have the worry of keeping the home fires burning down stairs—the burner tends to that automatically and keeps the house at exactly the temperature indicated in the thermostat. A far more healthful arrangement than waiting until everyone starts to shiver, then stoking furiously and overheating the house.

This is especially true in the between season months such as April or October. Often then a fire in the morning would be welcome, but would become decidedly too warm in the middle of the day. Since these between season months comprise, roughly, half the heating season, it can readily be understood how much more of a saving in fuel cost can be accomplished in these months by taking the chill off the air in your house for an hour or so, night and morning and then having the burner shut off for the rest of the day, instead of keeping a furnace fire banked all day with the resulting waste of fuel.

All burners can be used for heating domestic hot water, if desired, by means of an indirect heater connected to the boiler and with controls mounted in connection with the storage tank which regulate the temperature of the water, just as the temperature of the house is regulated. This is most satisfactory with steam heat, but it also can be done with a hot water system. With warm air a separate unit must be used. There are several good automatic units on the market using oil fuel. The cost of heating water this way will be found quite economical when compared with other automatic heaters.

The demand for homes equipped with all the conveniences of life is steadily increasing. Women are no longer satisfied with homes that are not modern in every respect. They know what they want and if the house they are offered does not have what they want, they won't take it.

Homes that have automatic oil heat are cleaner and easier to keep in order and almost sell themselves. Oil heated homes always sell quicker, all other things being equal, than those that are not. Therefor, most far seeing builders are putting oil heating equipment into their new houses as an insurance against carrying the houses unsold over a period of time which would then mean a mark down on the price.

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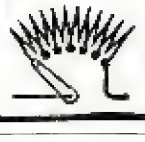

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Super-Refined Oil

By Alfred M. Caddell

(*Continued from page* 704)

vaporize in the order of their volatility. Then heavier oils, which form practically no vapors at atmospheric pressure, are helped in the process of distillation by means of steam or vacuum. This separation of grades goes on and on until all but approximately 15 per cent. of the original crude has been distilled, the various oil vapors in the meantime passing through cooling tubes and condensing at their respective vapor-condensation points, after which the products are piped to various tanks.

But in the group distillates used for lubricants, as also in the group used as fuels, there lies a whole world of combinations. Here the lubrication engineer steps in and, having ascertained the properties of the various grades by chemical and physical tests, and knowing the mechanical work he has in hand, writes specifications for the job just as a doctor writes his well-known prescriptions to make the body function as perfectly as possible. Some of the finest science of the age has thus come into being and mechanical creations, such as the automobile, airplane, motor boat and other contrivances powered by internal combustion engines, not only were permitted to be born but have been nourished into gigantic enterprises by virtue of this science.

Of all mechanisms contrived by man, however, internal combustion engines are without doubt the most difficult to lubricate. The exposure of a large part of cylinder surfaces to high temperature, caused by the heat of explosion and burning of the gas and air mixture, calls for lubricants of the finest grades to (1) provide and maintain the necessary film of oil between the piston and cylinder surfaces and (2) be sufficiently refined so that the minimum of carbon and other deposits will result from the breaking down process due to the heat and action of the motor. Other factors, such as freedom from sulphur and similar impurities, are also to be taken into consideration.

To make available the righ grade or specification of oil—in other words, to fill the mechanical and operating prescription properly—calls for the highest of technological skill and almost endless experimenting. The type of cooling system, the type of lubricating system and the rubbing speeds of the moving surfaces—all these with their endless variations form part of the data of the problem. Were the operating temperatures, contact surface speeds and lubricating systems the same for each motor—and most assuredly they are not—the problem of lubrication engineers would be greatly simplified. With gravity, flash and fire tests, pour-point test, viscosity, color (which indicates uniformity), acidity or alkalinity, tarry or suspended matter and emulsion factors to reconcile with specific jobs, the intricacy of the technology involved is fairly well indicated.

For instance, when William F. Parish, dean of the lubrication engineers, was made Chief of the Lubrication Division of our Air Service during the war—he had previously established lubrication standards for various governments and industries throughout the world, founded the lubrication divisions of some of our largest oil companies and done other work in this line—he set about the task of finding the most suitable lubricant to be used in the Liberty motors.

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Needless to say, therefore, that the operating success of the Liberty as well as other aero-motors, as far as lubrication was concerned, was highly successful because the lubricant had been properly standardized. But the wartime problem of supply and distribution—there were thirty army flying fields throughout the country and the forces in France to be served—brought about another development.

Mr. Parish, having gone into the technology of lubricants from the laboratory as well as operating standpoints, knew, among other things, that while lubricating oil did become contaminated through service, and while the lighter components of it could be and were broken down into vapors and carbon deposits, *the true lubricant itself was not worn out!* The contaminations consisted of gasoline, kerosene, dirt, metal particles and carbonaceous sludge. Therefore, thought he, if the used lubricating oil were put through a machine which separated the unwanted parts from the true lubricant, the lubricant could then be put back into service. Separating machines were thereupon devised and installed at the thirty flying fields, and during the last four months in which America was engaged in the war 109,560 gallons of lubricant were saved from what otherwise would have been discarded as waste. These

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The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

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Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

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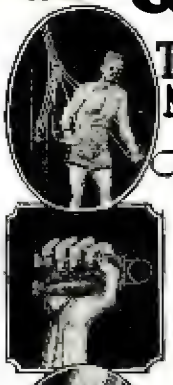

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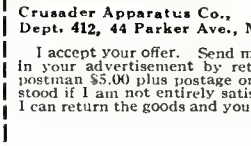

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separating machines are still in use at the various government flying fields today, and their use is fast spreading throughout the automotive world.

But is this cleansed oil as good as fresh lubricating oil? The surprising thing about it—at least surprising until one analyzes the situation—is that if the output of these separating machines is under the control of skilled oil technicians, *the output is as good, if not superior, to the original oil!* Put back into a motor—after the necessary tests to learn its chemical and physical characteristics, and blending it to the proper viscosity and other standards, if need be—this oil, being carbon-free and less volatile, will produce the most satisfactory results. Exhaustive tests in airplane, motor-boat and motor-car engines have been made. During operation, motor action has been superb, and when engines thus lubricated have been taken down, after a 500-mile test, they have exhibited a remarkably clean and sweet-running condition with the oil, which again and again may be put through the separator, found to be heavy in body and very much less contaminated—in other words, through this super-refining process, a true or net lubricant has been produced.

The reason for this is not hard to see, when one realizes, as of course the oil technicians do, that every finished oil put into the crankcase of a motor, is made up of a wide range of boiling points; various points representing the light oil, medium and up to the very heaviest cylinder stocks. Some of these fractions are naturally less stable than others. These are the parts that are destroyed quickest by the heat and action of the engine, and as a result of this destruction carbon is deposited on the metallic surfaces and becomes mixed with the oil itself.

Therefore this is where the beneficial effects of the heat and action of an internal combustion engine come in. The action which results in every particle of the oil coming into contact with the hot cylinder walls and piston heads enables the heat to break down the weaker components of the fresh oil, with the result that, while the oil does become contaminated, *it will become more refined* when the contaminations are removed. The greater the heat, the more thorough the refining job, the hot engine serving as a super-refining plant!

In fact, it has been said that in order to obtain the same grade or standard of lubricant that can be obtained from used motor oil, refiners would have to build very costly plants to duplicate the severe action of an internal combustion engine. And inasmuch as the carbon and weaker components would be broken down in such a process, the net result would be a reduced output by half, with the still further result that the cost of lubricating oil would rise to about $5 a gallon—an almost prohibitive figure from the standpoint of the motoring public.

It is no surprise, therefore, to learn of separating machines being installed in various fleet-garages throughout the country, the worth of the super-refined lubricant having been so thoroughly demonstrated. But right here enters a factor of the utmost importance—though the machines are capable of doing a fairly satisfactory separating job, how is the average garage man going to know the quality of his output, technically and chemically? Is he capable of conducting emulsion tests, viscosity tests, flash point tests; of blending oils to obtain certain characteristics? It is hardly to be expected that he should know much more than that the output of his machine is oil. Under these prevailing circumstances, therefore, a real danger

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confronts a motorist who pours an oil of unknown chemical and physical quality into his crankcase. He might be blessed with fool's luck and he might suffer the fate of fool's ignorance. So many factors enter into the science of lubrication that the field belongs entirely to the specialist.

The history of another industry yields a most striking parallel in this regard. Back in the early days of steel-making, Bessemer came upon a process by which he succeeded in making the finest kind of steel. His achievement was hailed by other steel and ironmakers and he sold licenses under his patent to them. But while they followed Bessemer's directions faithfully, they could not produce the steel that Bessemer could, and the inventor of the process felt obliged to buy back the licenses he had sold.

However, Bessemer was not discouraged by this setback. Far from it. He *knew* that he had and could always make good steel. Therefore, he reasoned, the trouble must lay in the iron which his licensees used.

Employing a chemist, he had this iron and also his own iron analyzed, and forthwith the reason for his licensees' failure came to light. Bessemer had unknowingly used an iron that contained only a small per cent. of phosphorous, while his licensees had used an iron high in phosphorus content. The small difference in the amount of this element's content made the difference between good, malleable steel and worthless, brittle steel!

But could Bessemer interest his former licensees in his process again? "Once bitten—twice shy" was their attitude until the very enormity of his success so overwhelmed them that they eventually repurchased licenses.

Maybe separated or super-refined lubricants will travel the same pathway of experience and maybe not. In the hands of skilled oil technicians, super-refined lubricants are known to possess exceptional merit. But in the hands of men who know little or nothing about this highly technical subject—well, the chances are that a motorist will first consider the life of his car.

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When the Fates Fooled Harry Kellar

By Dunninger

(*Continued from page* 701)

The prosaic world with its weary round and monotonous sameness was forgotten, for Kellar's audiences were always transported upon a magic carpet into the land of perplexing mysteries.

No large cumbersome pieces of the old time magician were part of his paraphernalia; here was a wizard of a modern school . . . a master of enchantment . . . a prestidigitator de luxe . . . a modern day miracle man!

Kellar . . . a name to be conjured with! For he had earned the title of Master of the Magic Art, from not only enthusiastic audiences in all parts of the world, but from the magicians themselves, who worshipped this genial, ever-smiling and lovable Grand Old Man of Mystery.

Kellar toured the world several times and met with deserving success, but in the earlier days of his career, his lot in life wasn't exactly a path of roses. Fortune didn't smile down on this world's great mystifier, and shower a deluge of golden coins for his efforts.

His was the hard, uphill road . . . covered with obstacles and disappointments. Sometimes it seemed to this master of magic that the woes and cares of the world were upon his shoulders. But he smiled and kept going steadily forward to success and prosperity. This sturdy plodder who knew not the meaning of quitting, forged steadily onward, making magical history as he went along.

The little old, back room in the Martinka magic shop, which stood in Sixth Avenue, between 28th and 29th streets, years ago was the meeting place of magicians from all over the world. Kellar, whenever appearing or visiting in New York, used to make that memorable shop his headquarters, and many is the yarn that was spun there in what the magis call "those good old days."

Martinka's magic emporium was known the world over as the depot of magical supplies, including tricks, books and illusions. Managed and owned by Antonio and Francis Martinka, it was in this quaint shop, some of the greatest magical paraphernalia of the time was planned, built and sent out into the world to mystify and thrill audiences when presented by the leading wizards of the day, headed by the great and only Harry Kellar.

The Mystic Lobster

ONE of the stories told of Kellar was that one night after the performance he wandered into a restaurant, known throughout the city as the place that served the finest sea food obtainable, and picked himself a lobster which was in a show case that stood in the window.

Telling the manager he wanted that lobster prepared for him, he sat down and looked over his newspaper. After a while the lobster was brought to him and the manager, who knew Kellar well, stepped over to the table and asked him how he liked it.

"That isn't the same lobster I fished out of the window," replied Kellar, in anger.

"What?" questioned the manager, "You mean to say that the lobster before you is not the same?"

"That's just what I did say," yelled Kellar, "And I'm right. I am surprised that you allow such substitution to take place in here, a place noted for its efficient service and——"

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"Wait a moment, Mr. Kellar," begged the manager, "Tell me how you know the difference between lobsters?"

"Come on out to the kitchen first," proposed the master magician.

So out into the kitchen they went, and upon inquiry the chef admitted that the lobster just served wasn't the one selected, and brought in by the waiter, that the manager had given him. The excuse was that the other one also being fresh and nearer to the chef's hand went into the process of preparation.

Leaving the kitchen the manager asked Kellar how he happened to know there was a difference, as both lobsters were of the same size, to which the wizard replied. "The lobster I picked had one of the teeth in the right claw broken." Which shows what sharp eyesight Kellar had and what a close observer of details he was.

Kellar enjoyed taking long walks. He used to amuse himself by picking out as many objects that came within his range of vision as he could. During his promenades he used to go over in his mind, different tricks and illusions he wanted to build at some future time. Kellar was democratic to his fingertips. Although his banners and lithographs shricked his fame, he remained the lovable, gruff at times, friend of everybody. To know Kellar was to love him. Naturally he made enemies too. What famous personage doesn't? But even his jealous rivals had to one and all admit that Kellar stood for all that was straight, staunch and true . . . a real man among men and a master among magicians.

How I Fooled Kellar

MANY the time he unfolded the tale of his earlier struggles when he had to escape from a hotel by hoisting his trunk through a window to a friend who stood below. That was in his younger days when the zest for adventure and the love of magic led him into tight places, from which he always somehow managed to escape.

You can easily do this trick as explained in the text, yet it completely fooled Kellar.

One afternoon in the old Martinka magic shop, I attained the distinction of mystifying Harry Kellar. I was standing in front of the iron grating, on the right coming into the shop from the street, looking over a book of magic. Kellar was standing a few feet away, talking to Tony Martinka. Finally Kellar called to me to watch a new *sleight* he had figured out. Kellar vanished a handkerchief and later made it appear from his right hand trouser pocket. "Now loan me that silk and I'll show *you* one." I promised, silently praying that the fates would not desert me before so critical a spectator.

Kellar handed over the red silk handkerchief he had just been manipulating. I carefully rolled it up—held it in my closed fist, and asked the dean to blow

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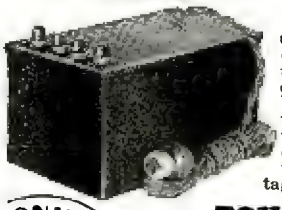

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upon it. This done, I allowed my hand, held about two feet from Kellar's face, to slowly open. The handkerchief was gone! I nervously laughed, but Kellar stood there blinking his eyes, completely mystified. "Well," shouted Kellar, "Where is the handkerchief?" "Gone," I replied.

Kellar began looking around, then started to search thru my pockets and sleeves. He was really completely mystified for the time being. And it goes without saying, I was more than delighted. I had fooled Kellar, the greatest magician of them all.

Now, I will have to let you, dear reader, into the secret of the trick, so you will follow clearly what happened later. The trick consists of rolling a handkerchief into a ball, and holding it in the palm of your hand. The hand is closed and a throwing motion is made, and at the count of "three," the handkerchief is thrown over the head of the victim. This move, the eye of the spectator is unable to follow. It's simple and an excellent trick and can fool the cleverest if he isn't in on the secret. Well, Dean Kellar wasn't, so he looked all around the place, and couldn't find the missing handkerchief. Now the thing that happened was, when I threw the handkerchief over Kellar's head, the silk supposed to fall behind the spectator's back, had landed on top of the master magician's black felt hat, and remained there. I decided to wait for an opportune moment to reach onto the hat and get rid of the handkerchief . . . so the trick would not have to be exposed. But that was not to be.

Kellar suddenly looked at his watch and made some remark about having an appointment, left the store hurriedly with me trailing in his wake. Disliking the fact that I would have to give the stunt away which had fooled the master magi, I continued to follow, hoping the wind would blow the handkerchief off the hat, but such was not to be the case. A number of people passing by, looked at Kellar and laughed. Several stood right in his path and burst into a spasm of laughter when he reached them. And all the time Kellar was growing more and more indignant and embarrassed, as he was wondering what the people were laughing at. Finally after looking himself over as well as he could, the professor took off his hat and there was the red handkerchief waving merrily in the breeze. Watching Kellar taking the silk from his hat, I spied him looking around suspiciously—assured that he had not seen me I took to my heels.

Laugh and the world laughs with you, believed Kellar, but there were moments when the laughs failed to arrive.

Assistants are a source of worry to magicians. It is far easier to find a clever magician than it is a good intelligent assistant.

One of the most competent and trustworthy of magician's assistants was Fritz Bucka, who travelled the world over with Kellar, and whom the dean of wonder-workers swore by and also at many times. Kellar trusted Fritz as he did himself, and Bucka was devoted to the grand old man of magic.

The Ghost That Didn't Appear

DURING the performance of the Kellar show, more than twenty years ago, the feature trick was the spirit cabinet in which the magician conjured up the ghost of the famous *Katy King*. This was a startling illusion of the spiritualistic type, and one that thrilled and mystified, in the years that followed, millions of lovers of mystery and spirit phenomena.

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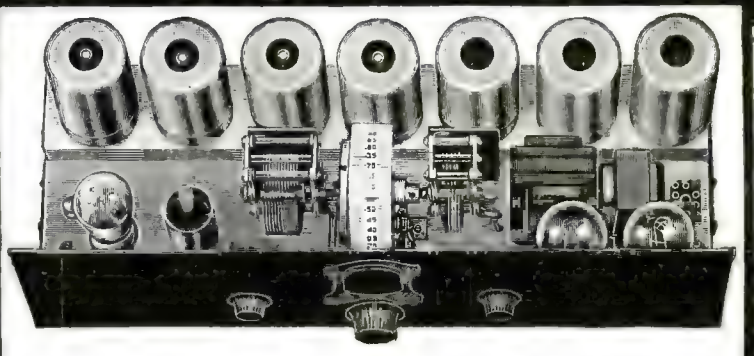

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The actor portraying the role of the ghost of Katy King entered the cabinet, unseen by the audience, through a door at the back. Fixed to this door was a special lock, the key of which Bucka, as the chief assistant of the Kellar show, had in his keeping at all times. The door between performances was locked to prevent prying eyes seeking to find that which they should not see.

On this particular night of the show, Kellar dramatically worked up the spirit materialization, and in his inimitable manner, announced the entrance into the cabinet of Katy King's ghostly spirit.

Once, twice, three times—the master announced the arrival of the spirit, *but no spirit!* What had happened? Kellar didn't know. Neither did any of the other assistants. Passing from that trick with an appropriate remark about the spirits holding a convention elsewhere that evening, he quickly went into another effect.

Bringing the next illusion to a fitting and sensational climax Kellar, bowing gracefully to the applauding audience, was as angry as a hornet.

His marvelous acting ability and showmanship hid his real feelings from even the members of the company, until the curtain fell on that act.

Kellar, who had worked himself into a frenzy, was beside himself with rage. Loudly he called for Bucka. "What is it you want, Mr. Kellar?" asked the quiet-going Fritz. "Want!" screamed Kellar, "Want! You're fired! You're through!!" Then he curbed his anger and continued on with the show. Between tricks he took back all that he had said in anger to Fritz, and wound up by saying, "Remember Fritz, don't let that happen again! See that the ghost gets into the cabinet hereafter."

Years rolled on. The ghost of *Katy King* appeared at every show.

Some twenty-three years afterward, Kellar continued to present the *Katy King* spirit materializing cabinet séance. It still was a big feature with his show. And, maybe this time it was a prank of the spirits, for one night history repeated itself . . . the spirit of poor old *Katy King* couldn't make its entrance into the cabinet.

Again the door to the cabinet was locked!

Fritz was busy rebuilding some stuff for the show and forgot to unlock the door.

This time Kellar didn't grow angry but after the curtain went down, the master magician called his trusty assistant aside, placed his hands on Bucka's shoulders, looked him in the eye and in a pained voice said, "Fritz . . . I am ashamed of you! The same mistake twice in twenty-three years!"

The Greatest Illusion of Them All!

SHORTLY after the above episode took place, Kellar arrived in New York and was royally entertained by members of the craft. One morning several magicians dashed into the magic shop rendezvous of Clyde Powers and each one displayed a circular announcing that at twelve o'clock that night a certain wonder-worker would present, at the corner of Broadway and Forty-Second street, in the middle of the street, the master illusion in which a woman would be levitated into mid air, and remain so, for a certain length of time.

Soon others of the magic clan arrived, each one with a similar circular. Much excitement and comment galore. Into the store walked Kellar. Some of the wizards showed him the circular. His face grew

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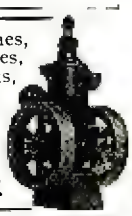

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purple with rage. And no wonder, for the levitation mystery was his original illusion, and one that had met with sensational success, wherever the master illusionist had presented it.

Telephones became busy, and the news of the proposed open air mystery show was told and retold. The mysterious illusionist, whoever he was, for none of the conjurers knew him, was at least assured of a large audience for his midnight performance, at the busiest corner in the world.

Three hours or so before the scheduled time, the magician enthusiasts began to arrive. I was there, too, and accompanying me was Kellar, La Vellma, Rush Ling Toy, Leon Caesar, and many other mystics who were interested in this unique demonstration.

The time dragged slowly. Minutes passed into hours, and the hours seemed unusually long. More than five hundred people, many drawn by the sight of the magic

Finally the hour of twelve arrived . . . and passed.

crowd, stood around thinking that something had happened . . . just what, they knew not. Several of the more talkative magicians informed those who asked what was about to take place.

Finally the hour of twelve arrived . . . and passed.

Nothing happened. Disappointment was written all over the strained, expectant faces of the magic fans.

Suddenly, someone hit the nail on the head as he asked, "What date is it?" "March 31st," replied another.

"It's after midnight . . . this is April 1st, isn't it?" queried the fellow.

"April fool!" yelled one of the crowd.

A roar went up from the crowd . . . seemed as if a million throats had shouted in unison.

We couldn't resist laughing at the way we were all taken in by the cleverly planned hoax.

The tricksters had been tricked.

Another article by Dunninger relating how another famous magician was fooled, will appear in an early number.

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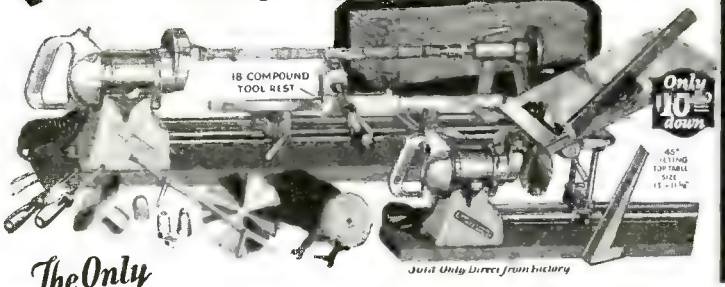

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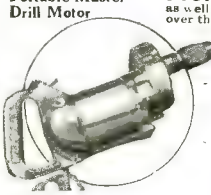

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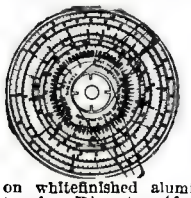

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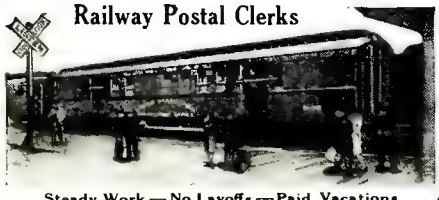

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(*Continued from page 713*)

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HAT RACKS similar to the one illustrated are right popular now, and anyone with any turning ability will be able to turn this simple article. It should be gaily painted and zigzag modernistic stripes can be added to further the decorative idea. The feet are made by hand and glued in the holes bored for them.

Ash Trays

A SET of ash trays for bridge tables will make an acceptable present. This job calls for face plate chuck turning which has been explained before. It would be well to turn the bottoms of the entire set first, and then make a chuck to fit this bottom and turn the top or inside. The semi-circular grooves can be easily cut with a sharp half-inch bit by placing the lips of two of the turned trays together and boring in the crack. Short pieces of half-inch brass tubing split lengthwise and filed to fit should be tacked into these grooves. A Chinese red or jade green enamel will be the most satisfactory colors to use.

Fruit and Nut Bowls

THE fruit bowl is turned and built up in three sections. The center or upright is simple turning with a tenon on each end to glue into the base and bowl. The bowl will call for a large piece of wood mounted to the face plate, hollowed out and rounded off in one operation, or the hollowing out may be done and then the piece turned around and chucked for the rounding off process. In either case, due to the size of the piece, difficulty may be experienced.

The base has a hollowed out place in the bottom into which melted lead should be poured on completion, to keep the bowl from being top heavy.

The finish should probably be mahogany or walnut with a rubbed varnish finish. After gluing the parts together, a piece of felt glued to the base will complete the job.

The Sewing Stand

THE sewing stand will be a very useful present to mother, wife, or sweetheart, and may bring results in darned socks and sewed-on buttons.

It has a place for the thimble, a pincushion, button tray, and rods for spools of thread. The table must not be glued, in order to allow it to revolve freely, and it should be made from a piece of plywood to prevent its warping.

The rods are made from 3/16 inch dowels, or they may be planed by hand from hardwood squares and driven through a 3/16 inch hole to round them up. Great care must be taken to set them square, in gluing.

The construction of the post and base need no explanation. The base should be loaded as with the fruit bowl. The pin cushion hollow is packed with cotton and a piece of cloth is tacked over the top to form a cover. The finish may either be stain and varnish or painted.

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Have Sport With This Buck Boat

(*Continued from page* 718)

boat being used. The inside end of each rod passes through the 1¼ by 2½ inch upright and a pin put through a hole to hold it in place. These uprights are fastened to the bottom of the boat by a sheet iron collar cut and bent as shown at the right and the upturned portions are tacked to the post while the flat piece is tacked to the boat bottom. A strap iron brace is also provided for the front side, to set at an angle, the top being fastened with a lag screw and the lower end with a screw which is too short to pass through the boat bottom. This is, briefly, the manner of making the apparatus. Now for the details.

The two bicycle wheels should have the rims, spokes and hubs in good shape. If the rim is a bit wobbly straighten it by tightening some of the spokes. Then give the rim, if it is wood, two liberal coats of paint and let dry.

Twenty-four paddles will be needed for the two wheels. Each one is cut from a sheet of rather heavy galvanized iron 4 inches wide and 8 inches long. The paddle itself is 4 inches square and a 1¼ inch wide projection extends for another 4 inches with two triangular pieces left when the cutting is done for braces. These are bent on the dotted lines up to right angles when the paddle has also been bent to shape and are soldered in place as indicated. These braces will give the paddles much greater strength. The narrow tongue is provided with two small holes for screws.

Space off each rim into 12 equal parts and then fasten the paddles in place with two wood screws. By pounding these tongues with a round headed hammer you can get them to lie quite snugly in the concave side of the rim. You can cut small notches in the bottom edge of each paddle for the edges of the rim if they will not fit tight enough otherwise. This done, apply paint or varnish to the edges of the tongue to keep out water from underneath. This would cause warping of the wood possibly, and perhaps rusting of the metal.

With the two wheels finished, fit the upright supports on the sides of the boat, about 2/5 of the distance back from the front end. These should be 1 inch thick, 2½ inches wide and high enough to bring the lower edges of the wheel rims about 4 inches under the water line when the boat is in use. In doing this the paddles themselves will extend two or three inches below the bottom of the boat.

Now bore one hole through the top of each piece just large enough for the rod. If you have access to a junk pile find, if possible, a short piece of iron or brass pipe which has an inside diameter large enough for the rod to fit through it. If you can find such a pipe, bore the hole through the upright big enough for this pipe. Cut off a piece long enough to extend through it, then drive it to a fit. This will make an excellent bearing and the friction will be kept down. With the wood bearing even when the wood is well soaked with oil, water getting on it will possibly cause swelling and hard turning.

This pipe bearing idea can also be used with the upright bearings in the middle of the boat. Be sure the four bearings are in line and all exactly the same height. Insert the rods now and make sure that they turn easily. Nail or screw the uprights to the side of the boat. Place a washer between the pin and the inside upright bearing when assembling. Then

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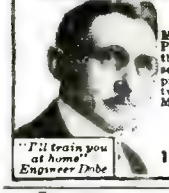

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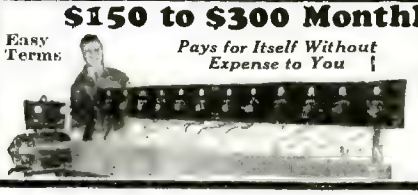

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put one wheel over each outer rod end and fasten in place. This can be done by drilling a hole through both wheel hub and rod, or by slightly deforming the rod at this point and filling the hub around the rod with melted babbitt. Be sure the wheel will turn true when the rod is revolved. In bending the rods to shape the sharp right angle bends can be better formed if the rod is heated at these points to a cherry red. Care must be taken to keep the rod perfectly round at least at the portions which are to pass through the bearings.

For greatest comfort there should be room between the boat bottom and the arms at the down stroke for the user's legs to pass under. A seat, built at a comfortable distance behind the rods will in some cases prove satisfactory; on others the operator will prefer to sit flat upon the boat bottom, or stand upon his knees. There is still plenty of room ahead of the mechanism for one or possibly two people and three wide boards set upon cleats nailed to the boat's sides can very easily be put in.

Several washers placed between the wheel hubs and the sides of the boat will prevent rubbing of the paddles although if the outside uprights are quite thick, this will not be necessary.

If the water in which you are to use the boat is quite deep and of uniform depth without any hidden obstructions, you can easily add to the side and area of the paddles by soldering a 4 by 6 inch extension to each one. This will cause the wheels to turn harder, but will give considerable more "push" to the boat.

This same plan can be used with almost any boat but the home-made kind with straight sides will lend itself best to this arrangement. On the side of the boat near the front, letter on, with paint of a contrasty color, some suitable name. Then look forward to a lot of pleasant hours using it. It is an exceptionally good boat to fish in because you do not need to worry about the paddles floating off.—Dale R. Van Horn.

In RADIO NEWS
for December, 1929

THE NEW VOICE OF EDUCATION—How modern speech amplifier apparatus is being used in one of the new high schools, and what such installations mean in a money-making way for radio servicemen.

A SOCKET POWER RECEIVER FOR DIRECT CURRENT DISTRICTS—Complete circuit and constructional detail of a receiver designed by David Grimes and intended for batteryless operation where the line supply is d.c.

A UNIVERSAL METER—Circuit and construction details of a testing meter for the experimenter and radio serviceman.

HAMS TAKE WINGS—Ralph P. Worden tells how the Cleveland Wireless Association maintained constant contact over the air meet race course with the judges' stand.

WHEN CAMERA MEETS "MIKE"—Carl Dreher discusses the intricacies of radio and sound technique in connection with the production of talking movies.

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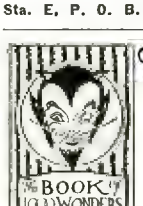

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Measuring Heights and Depths with Sound

By Botho Von Romer

(*Continued from page 692*)

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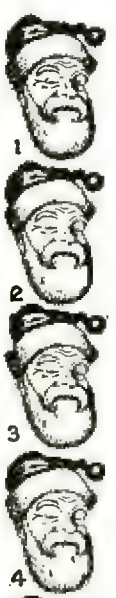

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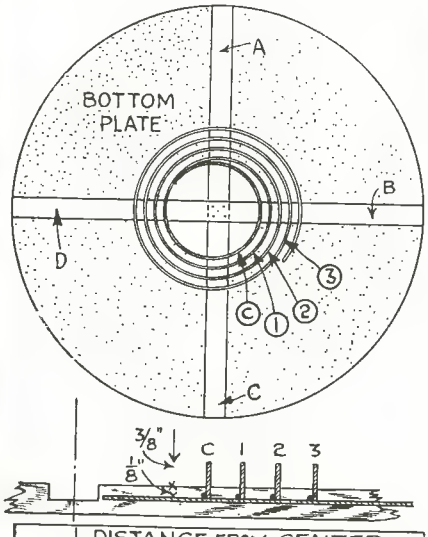
Home Movies

By Don Bennett

(*Continued from page* 712)

Developing the Movie Film

ABOUT a half gallon of solution is sufficient for filling the tank with developer, and after the rack has been filled with film, starting from the inside, the rack is placed in the tank and the developer poured in the center hole. Normally exposed film will develop in from five to seven minutes at 65 degrees Fahrenheit.



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C	2	2 1/8	2 3/8	2 5/8	2 7/8	3 1/8	3 3/8	3 5/8
D	2	2 3/16	2 7/16	2 11/16	2 15/16	3 3/16	3 7/16	3 11/16

Details of film rack. Fig. 7.

All the operations of loading, developing and fixing must be carried out in the dark room under a safelight. A twenty-five watt ruby bulb is satisfactory if used not closer than six feet from the film. A safelight of the No. 2 type is satisfactory and can be used close to the film. (Use No. 3 for panchromatic negative). When the film has developed sufficiently (until the black parts show through the back of the film) lift the rack out of the tank and transfer it to a second tank, which contains water with two ounces of 28 per cent acetic acid added. This is the *short-stop*. Leave it in this tank for a minute or so and transfer it to the fixing bath where it should stay until all the yellow color has been fixed out. After three or four minutes in the fixing bath, a dim white light may be switched on so that the film may be inspected. Twenty minutes in the fixing bath is usually sufficient but if the bath is weak let the film remain until thoroughly fixed. It is then removed to another tank where the film is thoroughly washed. A short hose attached to the faucet is placed in the center hole so that no strong current of water strikes the emulsion of the film. An hour's washing is usually necessary. After the first ten minutes, empty the water from the tank and fill it up again. Repeat this procedure every ten minutes until the hour is up. Lack of proper washing will cause the film to stain and appear dirty, in time bleaching away all the image.

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Drying the Film

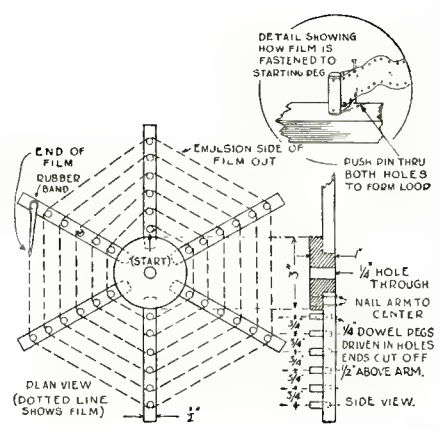
AFTER the film has been washed it must be dried and the handiest way to do this is on a circular drying rack such as the one shown in figure 7. This drum consists of two circular ends 24 inches in diameter with half-round slats placed at about six-inch intervals around the edge. A shaft through the center supports it and it is revolved at a high rate of speed by a motor. On good days films will dry in an hour's time, less if placed in a draft.

After the negative has been developed, it is necessary for us to make a positive print. In order to do this we must hold the negative and the positive film in contact while a light is exposed to the film. Film finishing laboratories have special printers which do this thoroughly but they are expensive machines and we must improvise one that will do the work sufficiently well for our purpose.

How to Make a Positive Printer

FIG. 1 shows an amateur projector converted for this purpose. The conversion does not affect its use as a projector nor is it a complicated job. As you can see from the illustration, an extra reel arm has been added in front of the regular arm. This is simply a strip of wood or metal having at its upper end a shaft which supports a hundred foot reel. On this reel is placed the negative while the unexposed positive stock is placed on the regular reel arm. A C-clamp holds the strip in the desired position. The projector is threaded in the usual way except that two films are threaded instead of one, the positive away from the lamphouse and the negative between the positive and the light. The regular lamphouse and lamp are removed. The negative and positive are so placed that the emulsion side of each is in contact. The cover of the gear box is removed so that the film may be inspected as it passes through.

The lens is removed from the projector and in its place is inserted the tube of the lamphouse. (Fig. 2). This tube presses firmly against the aperture plate so that no light leaks out to fog the film and with this point in mind, we paint the inside of the tube dead black. As you can see from the photograph (Fig. 1) and the drawing (Fig. 2). The lamp is placed on a sliding base. This is so that the amount of light reaching the film can be varied to suit the density of the negative. (Light density varies as the squares of the distance from the source). When the light is against the tube it is at its strongest in relation to the film, when the stick is pulled back all the way, the smallest


DETAIL SHOWING HOW FILM IS FASTENED TO STARTING PEG
END OF FILM
RUBBER BAND
EMULSION SIDE OF FILM OUT
PUSH PIN THRU BOTH HOLES TO FORM LOOP
START
¼" HOLE THROUGH
NAIL ARM TO CENTER
⅛" DOWEL PEGS DRIVEN IN HOLES ENDS CUT OFF ½" ABOVE ARM.
PLAN VIEW (DOTTED LINE SHOWS FILM)
SIDE VIEW.

Simplest form of film rack for developing process. Fig. 6.

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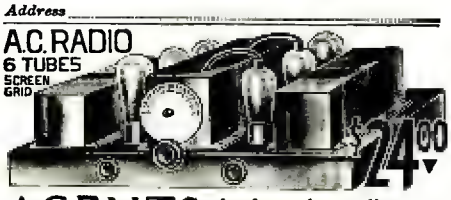

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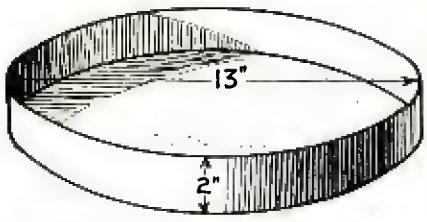

DEVELOPING TANK FOR FILMS

Fig. 5.

of light reaches the film and therefore the exposure is less. The placing of the light for each scene must be determined by experiment. The simplest way is to make a test strip a foot or so in length, develop and fix it and then regulate your light to give you better results. With experience you will be able to judge the negative density and the strength of light to use in almost every case. You will notice that only one take-up reel is provided. The positive film is run onto this and the negative is allowed to run into a basket on the floor, to be reeled up later at your convenience.

Developing the Positive Film

THE positive is developed in the same way as the negative except that a different formula is used. With both positive and negative you must remember to wipe off the back of the film after it has dried but while it is still on the drying drum, by applying a chamois dipped in alcohol to the back of the film as you rotate the drum by hand. This is essential, as otherwise "drying marks" will remain on the film and spoil the picture on the screen.

Figures three and four show a printer and nesting tanks that may be purchased. Any dealer can get these for you. Likewise your regular dealer can get the raw positive stock and the chemicals for you. The No. 16 developer can be purchased ready-mixed, requiring only the addition of the proper amount of water.

There are many tricks that can be done with the printer, you can reserve action, print upside down, double and triple print, make duplicates of your films and many other tricks that will be apparent to anyone. To print reverse action it is necessary to move the lamphouse around to where the regular lamphouse is placed so that the shutter will cut off the light. Place the negative on the upper reel and the positive on the lower. Put the crank on the projector and practice turning one frame at a time at a regular speed. Then thread the projector through the gate only, don't use the feed sprocket. Expose the first frame of film by quickly turning the crank. With the shutter closed (the light may be switched off each time) move the negative *down* one frame and the positive *up* one frame. Repeat this until the end of the scene is reached. It is tedious work but the good things don't come easily!

Comic Effects by Trick Printing

A COMIC effect can be obtained by making a stop motion of a person. This is done by printing a scene in the usual way but with the use of the crank, so that all exposure will be the same and suddenly stopping the negative while allowing the positive to run on. To do this, just advance the positive film by hand and re-threading each time while the same negative frame stays in the gate for a while. If this is done for twenty frames, then the negative allowed to go on for ten

Dex Hamlin fights alone—

WHEN Dexter Hamlin signed on as ordinary seaman with an Amazon tramp steamer between college years, he little dreamed that the adventure he craved would almost prove his undoing.

It all started when the bos'n picked on his undersized pal. Dex, of course, had to fight it out, and then jump ship. That jump took him straight into the Brazilian jungle and a two-year jail sentence in the filthy rubber camps. How Dex rebelled and fought alone against the fiendish cruelty of the half-breed rubber king is but one of the dozen stirring tales of strange adventure in foreign lands appearing in December Brief Stories.

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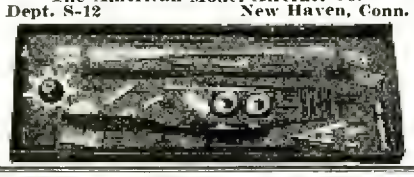

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frames, when another stop is made, the effect on the screen is quite comic.

Double printing is simply the placing of two negatives in the printer with a single piece of positive. More light must be used than with a single negative. Action titles can be made in this way by negative of a scene. A trick "Talkie" superimposing a title negative over a scene could be made by having two characters talk dialogue, and over their heads have the words appear. All this involves the making of the negative titles, so that they will locate over the head of the character who is speaking the lines and then double printing.

Caution

When threading the projector for printing leave plenty of loop in both positive and negative and have the loops of different lengths.

Wash the backs of all films before removing from the rack with alcohol.

Always work in a dark room with the proper safelight.

Use pure chemicals in the exact proportions given in the formulae.

Don't keep developer. It is no good after standing.

Hypo may be reinforced by the addition of more hypo and a small amount of alum.

Developer Formulas for Use With 16 Millimeter Film

(Note—While this formula is excellent for both positive and negative films, separate solution should be employed, that is, use one batch of solution for negative and another batch for positive.)

Water	1 gallon
Metol	18 grains
Sodium Sulfite (Anhydrous)	5 ounces, 130 grains
Hydrochinon	350 grains
Sodium Carbonate (Anhydrous)	2½ ounces
Potassium Bromide	50 grains
Citric Acid	40 grains
Potassium Metabisulfate	87 grains

Mix in order named, dissolving each chemical thoroughly before adding next one.

Develop 7 minutes at 65 degrees Fahrenheit.

FIXING BATH

Hypo (Sodium Thiosulfate)	3 pounds 6 ounces
Water	1 gallon
Bisulfite Lye (Saturated solution)	.24 ounces (fluid)

Dissolve hypo in hot water. When thoroughly dissolved add Bisulfite Lye. Fix film in this bath until clear of yellow color. (20 minutes). Wash thoroughly for one hour in six changes of water.

When It Rains Fish, Worms and Frogs

(*Continued from page 695*)

of such showers, covering a period of many centuries and vouched for by scientific and other journals. Here are a few:

In 1804 the French Academy reported a rain of frogs and toads near Amiens, France, in immense numbers "covering the roads so that the diligence passed over, killing many."

In "Athenaeum," July 17th, 1841, there is an account of a thunderstorm at Derby,

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England, that brought down "hundreds of small fish and frogs"—"from one-half an inch to an inch long."

In "Annals and Magazine of Natural History," January, 1929, Dr. E. W. Gudger tells of a downpour of menhaden or shiners that fell on the deck of a fishing boat in Vermilion Bay, Louisiana, in 1921.

Frogs fell to earth at Ithaca, New York, in 1901, and at Spokane, Washington, in 1904, in such numbers as to impede railroad traffic by rendering the rails slippery.

At Santa Isabel, Mexico, on the authority of the Mexican Minister of Agriculture, salt water fish fell from the clouds in 1925. This town is two hundred and fifty miles from salt water.

In 1901 live pollywogs fell on Fourth Avenue, New York City, as told in the *New York World* by William Foulke, then treasurer of the American Bible Society.

At Iron Hill, Maryland, in 1900, the rain brought down small frogs, earthworms and sea turtles. In 1857 Montreal was visited with a rain of little lizards; and jelly fish "about the size of a shilling, spattered" as they fell on the streets of Bath, England.

At Danville, Virginia, in June, 1926, local and other newspapers were full of accounts of a rain of immense numbers of little fish.

The popular and most plausible theory is that these creatures are sucked up by some passing whirlwind, carried about by the winds, and deposited to earth, often at some distant place. Opinions differ, however, as to whether the animals themselves are taken aloft, alive and matured, or whether it is the spawn that is so sucked up and hatched out in the clouds.

Although hundreds of reliable people have seen the down-coming phenomena, nobody has yet seen the creatures on the way up.

In AMAZING STORIES
For December

VAMPIRES OF THE DESERT, by A. Hyatt Verrill. After a rainfall, a good part of the arid deserts of Chile, Peru and Bolivia are covered with abundant vegetation. Suppose some change occurred in the ocean currents to give greater rainfall in those regions. Is it beyond the realm of possibility to say that the almost fossil seeds of prehistoric plants might come to life again? At any rate, it is a clever idea, ingeniously built up into a scientifiction story of Verrill's highest order.

A BABY ON NEPTUNE, by Clare Winger Harris and Miles J. Breuer, M. D. Any piece of fiction collaborated on by these two favorite authors ought to be good. It is. When Hertz got a little spark from a distant electric discharge through a stone wall, it was a triumph. Now we hear, without much comment, that a set made by one of the Edison students caught Byrd in the Antarctic. Is it such a far step to radio to another planet? These authors' conception of life on another planet is different than anything else we have ever read about. It is well worth a studied reading.

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Solution of Cross-Number Puzzle

(*Continued from page 715*)

3	3	■	9	0	8	■	4	1	6	■	1	6
1	0	■	8	8	4	■	1	5	5	■	1	8
■	2	5	0	■	3	4	4	■	9	9	9	■
9	5	0	■	3	7	5	■	1	2	6	6	0
9	0	■	6	3	5	■	7	9	2	■	9	5
6	8	1	5	3	■	6	0	3	■	6	0	0
■	■	7	5	■	0	0	0	■	8	8	■	■
5	5	6	■	8	3	2	■	2	9	0	8	1
8	0	■	8	0	8	■	9	7	5	■	1	1
4	3	5	6	0	■	6	6	2	■	6	4	0
■	6	1	4	■	1	1	5	■	1	2	8	■
4	0	■	9	9	4	■	8	8	5	■	1	3
7	0	■	8	2	4	■	3	1	0	■	8	9

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County of NEW YORK }

Before me, a notary in and for the State and County aforesaid, personally appeared Arthur H. Lynch who, having been duly sworn according to law, deposes and says that he is the Editor of Science and Invention, and that the following is, to the best of his knowledge and belief, a true statement of ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24th, 1912, embodied in Section 443, Postal Laws and Regulations, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Experimenter Publications, Inc., 381 Fourth Ave., New York City; Editor, Arthur H. Lynch, 381 Fourth Ave., New York City; Managing Editor, H. Winfield Secor, 381 Fourth Ave., New York City; Business Manager, H. K. Fly, 381 Fourth Ave., New York City. 2. That the owner is: Experimenter Publications, Inc., 381 Fourth Ave., New York City, B. A. Mackinnon, H. K. Fly. 3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.) Signed, Arthur H. Lynch, Editor. Sworn to and subscribed before me this 24th day of September, 1929. (Seal) Joseph H. Kraus, Notary Public, City of New York. (My commission expires March 30, 1931.)

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The Why of an Investment Trust

By Alfred M. Caddell, *Financial Editor*

YOU have often heard that this is an age of specialization; that the affairs of life have become so complicated that unless one specializes in this activity or that he will not ring up a high score.

Translated into terms of investments, this means that unless he knows his subject backward and forward and is capable of viewing the investment situation with a clear perspective, he is not going to make himself as much income as his money, properly applied, is capable of making for him.

The wise investment of money is one of the most difficult tasks confronting the modern business man, principally because it involves laboriously accumulated savings. Moreover, investments cannot simply be made and forgotten; they must be watched with unfailing vigilance and appraised and re-appraised with the growth of time. To be able to do that intelligently requires more than ordinary investment knowledge.

Until recent years we did not have in the United States any outstanding institutions whose sole business was the management of investment funds by giving thereto the same intelligent study found in our other arts and sciences and professions. Each of us went on our own individual way, selecting investments calculated to increase our private fortunes But most of us, it may be more or less safely said, couldn't devote enough time to this important undertaking to make any huge success of it.

But, as with most everything else, scientific efficiency, either personal or otherwise, must always rise to the top.

The Investment Trust type of company came into being as a natural sequence of the growing interest in investments—a management institution to take care of the requirements of many investors, large and small. This type of institution had its origin in England where it has flourished successfully for many years. Lately, it acquired a foothold in the United States and its expansion has been so rapid that today investment trusts number more than 450, about half of which sprang into being during the past year.

The capital of an investment trust is obtained by the sale of securities to the public. With this money the officers of the trust purchase or sell stocks or bonds, underwrite security issues and otherwise engage in a broad financial practice even to the extent of loaning out money on call. Most of the trusts safeguard their investments by investing not more than five per cent of their capital funds in any one security. A good deal of their safety consequently lies in diversity of holdings, for with anything like conservative and intelligent management the law of averages is bound to work in their favor—if one investment doesn't pay out so well, it should, by reason of wide diversity, be counterbalanced by an investment that yields a very good income.

Naturally, the reputed super-knowledge of investment trust management lies in the scientific attention that they give to their business. There are few investment trusts worthy of the name who do not maintain a staff of financial experts constantly employed—statisticians, economists, financial observers and such like, who keep a weather eye on the economic affairs of the world and a practical ear to the ground of things financial, so that the net result is knowledge upon which the executive management may wisely act.

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quires that such companies must incorporate—are worthy of public confidence, however. There are too many loopholes in the present laws which defects allow unscrupulous persons to engage in a blanket sort of investment—in some cases, sheer speculative—businesses, thus jeopardizing the funds entrusted to them by the public. Safeguards, such as are thrown around savings banks, life insurance companies and others, may probably come into being to prevent possible abuses of such funds. As with everything else, an investor must use proper discretion and discriminate most intelligently between the responsibility of one investment trust and another. There are plenty of good ones to choose among and unless all signs fail investment trusts are destined to play even a larger part in our investment world than they have up to the present.

For one thing, this type of institution when ably managed can do much to stabilize the market prices of securities. More and more bears are finding it difficult to raid the market in the hope of driving down prices to levels at which they would prove to be bargains. The recent buying on the part of investment trusts did much to bring back security prices from the low of last May. There are any number of instances on record where this type of institution now holds securities which were purchased 50 or 100 points lower than their present values. And what is more, owing to the large sources of capital at their command, investment trusts have been able to purchase what are ordinarily regarded as rich men's stocks—the securities that yield not only dividends but melons in the form of stock dividends. And as a general rule, investment trusts of this type are holding such stocks for future appreciation.

Questions and Answers

Conducted by Alfred M. Caddell
Financial Editor

Question—Can you tell me anything about the possibilities of Phillips Petroleum? I have been holding 100 shares for two years, same having cost me ten points higher than the present market price. L. L. F., Bayside, L. I.

Answer—I would not regard Phillips Petroleum as a risk, and would suggest holding it, believing that it will come back and show you a profit over dividends. The wrong time to sell any stock is when it is down, unless all signs point to a complete abandonment of an industry. This is far from the case with oil. Phillips estimates a satisfactory increase in net for the third quarter of 1929, and earnings for 1929 may confidently be expected to surpass those of 1928.

Question—I am worried about my holdings in General Motors, which I bought at 80. Should I sell at the present market or hold in hopes of recovery to that point? F. P. B., Lancaster, Pa.

Answer—I'd hold General Motors, particularly if you own it outright. At the present writing the stock is about 28 points from its 1929 high, but in so progressive a leader as General Motors one can say that it is only taking a much-needed rest and that it will wake up with new energy as soon as credit conditions become easier. General Motors is in so many industries—automotive, aviation, iceless refrigeration, etc.—that its potential earning power is increasing rapidly.

Question—What do you think of Andes Copper? I have been disappointed in the action of copper stocks. H. R. A., Springfield, Ohio.

Answer—The trouble with the coppers is principally due to influences other than the intrinsic merit of these stocks. Copper companies began to show up good in earnings rather late, and inasmuch as much money was tied up in other securities coppers could not be taken care of. Andes Copper is a subsidiary of Anaconda Copper, one of the best in the copper group, and Andes will undoubtedly reflect its present earnings and possibilities in a much more satisfactory way at an early date.

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INDEX TO ADVERTISERS

PAGE

A

Airplane Spruce 756
Allied Radio Corp. Inside Front Cover
American Business Builders... 681
American Correspondence School of Law 750
American Model Aircraft Co... 761
American Sales Co. 765
American College 748
American School, The 764
American School of Aviation.. 752
American School of Photography 765
American Technical Society.... 756
American Telephone & Telegraph Co. 749
Anita Institute 762
Arms, I. A. 758
Atlas, Charles 738
Audel & Co., Theo. Inside Back Cover

B

Bastian Bros. Co. 748
Bernard & Heller 742
Blandin, Ernest W. 752
Bliss Electrical School 744
Bureau of Inventive Science... 742

C

Campbell Co., Wm. 757
Chicago Air Service.....Back Cover
Chicago Salvage Stock Store... 768
Chicago Stock Gear Works. 752
Clarkson Pub. Co. 752
Cleary, C. M. 744
Conn, Ltd., C. G. 746
Copeland, Lewis 740
Coyne Electrical School 675
Craftsman Wood Service. 758
Crusader Apparatus Co. 746

D

Dayton School of Aviation.... 763
Deagon, Inc., J. C. 760
Delta Specialty Co. 737

PAGE

D

Detroit School of Lettering.... 750
Dobe, Engineer 755
Douglas, Lyle 756
Drake, Frederick J. & Co..... 758
Dryer, J. A. 758
Dynamic Mfg. Co. 744

E

Eagle Model Airplane Co..... 762
Elgin Radio 760
Encyclopaedia Britannica..... 677
Evans & Co., Victor J. 745
Excello Products Corp. 762

F

First Hawaiian Conservatory of Music, Inc. 764
Fisher Mfg. Co., Adam..... 744
Franklin Institute 746-754

G

Gerold Co., The 764
Gilson Slide Rule Co. 754
Gottlieb, Edward 744

H

Health-O-Quality Products..... 763
High Frequency Labs. 751
High School Home Study Bureau 736
Hobart Bros. Co. 750-755
Honigman, A. 756
Hoodwin Co., Chas. 764
Howard Engine & Mfg. Co..... 752

I

Ideal Aeroplane & Supply Co., Inc. 748
International Correspondence Schools 749-752-765
International Typewriter Exchange 758
Inventors Service Bureau..... 744

PAGE

J

Jeffries Transformer Co. 762
Jenkins Corp. 752-756-764
Jiffy-Tite Mfg. Co. 764
Johnson-Smith & Co. 739
Jowett Institute of Physical Culture 752

K

Kelsey Co. 758

L

Laboratory Materials..... 750
Lacey and Lacey 742
Landon School, The 750
LaSalle Extension University.744-761
Leonard, A. O. 756
Liederman, Earle 732
Lincoln Airplane School 764

M

McGraw-Hill 735
Marvel Mfg. Co. 754
Mead Cycle 760
Metal Arts Co., Inc. 762
Metal Cast Products Co. 765
Midland Appliance Corp. 748
Miller, Carl 742
Model Airplane Book Pub.... 764
Motor Institute of America 756

N

National Radio Institute..... 673
National School of Visual Education 761
New England Mills Co. 750
New Method Mfg. Co., Inc...744-764
New York Institute of Photography 759
Northwestern School of Taxidermy 758

O

O'Brien, Clarence A. 743

P

Pan-American Band Instrument & Case Co. 761-762
Paris-American Pharmacal..... 754

PAGE

P

Patterson School 758
Pelman Institute 733
Plapao Labs., Inc. 762
Plymouth Rock Squab Co. 752
Polachek, Z. H. 742
Projectionist Sound Institute... 741
Publishers' Classified Service .. 751

R

Radio Institute of America.... 731
Radio & Television Institute.... 683
Radio Training Ass'n of America 679
Randolph & Co. 742
Remington Rand Business Service 678
Roat & Lohman 756

S

Sasnett, Edward C. 744
School of Engineering of Milwaukee 734-753
See-Jay Battery Co. 744
Smith Typewriter Sales Corp... 761
Standard Business Training Institute 750
Stone, L. M. 757
Studebaker Corporation of America, The 747

T

Tamblyn, F. W. 752
Teleplex Co. 763
Thorola Radio Products 763
Townsend Labs. 750
Tenor Banjo Studios 748
Trilety, M. 756

U

U. S. Model Aircraft Corp..... 758
Universal Aviation Corp..... 758

W

Waco Tool Works 753
Western Radio Mfg. Co.....752-765
Whirlwind Mfg. Co. 763
Wilferd, L. E. 755
Wollensak Optical Co. 765

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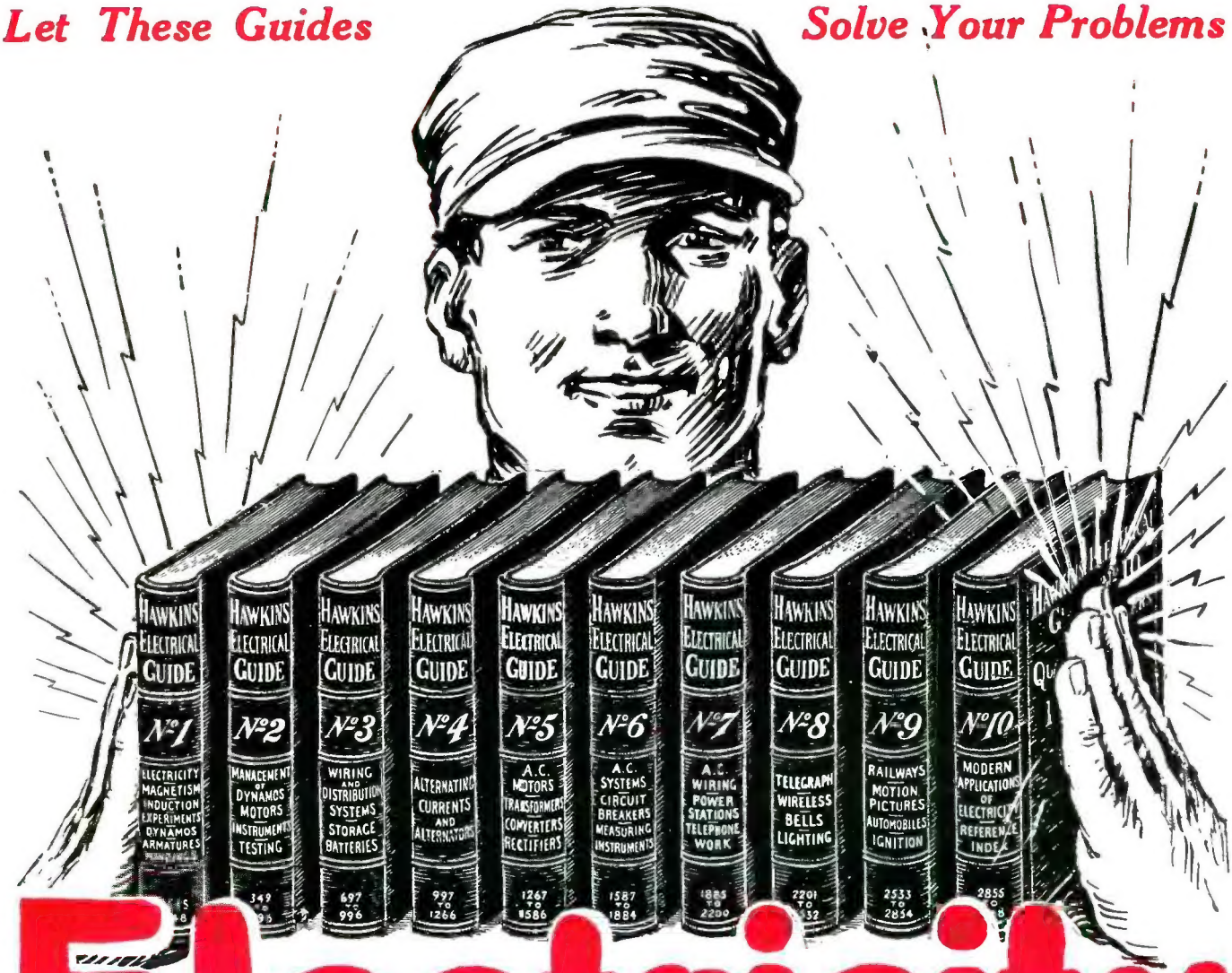

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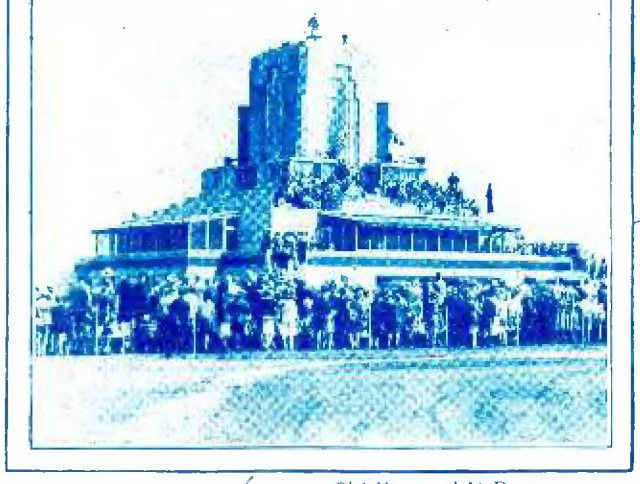

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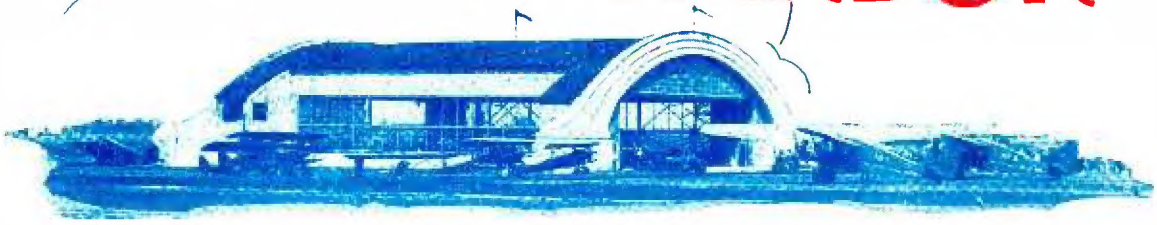

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